OLYMPUS®

MAINTENANCE MANUAL

USG-400

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INTRODUCTION

Introduction

Repair and maintenance of this product requires highly specialized knowledge and techniques. We recommend that you contact an Olympus service center in your area if a problem develops with the product.

If repairs or modifications are made by personnel not authorized by Olympus, the warranty is void, and Olympus shall not be liable for damage that occurs to or as a result of use of the modified product.

Applicable Unit

USG-400

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Trademarks

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Chapter 1 : Product Outline

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1 Outline

(1) Purpose of Use
The THUNDERBEAT instruments are intended for use of coagulation/cutting of tissue and sealing/cutting of vessels in combination with the ultrasonic generator, the electrosurgical generator and the THUNDERBEAT transducer that are specified by Olympus in general surgery (including endscopic and microscopic surgery)

(2) Allowable Combinations
This product can be used in combination with the products listed in system diagram.

2 Features

(1) This product, which has two handpiece connectors, enables dissection and coaguration of body tissues by plugging the handpieces int their corresponding handpiece connectors.
- THUNDERBEAT Connector (Handpiece Connector 1) : SEAL & CUT output / SEAL output
- SONICBEAT Connector (Handpiece Connector 2) : Ultrasonic output

(2) PLL resonance tracking control and constant current control enable stable ultrasonicvibration.
(3) Various setting are shown on the touch-panel LCD. They can be changed on the display.
(4) All the devices have their own hand switches that enable ON/OFF control of output.
(5) All the devices have their own foot switches that enable ON/OFF control of output.
(6) This product has the interface for output interlock and the output can be controlled.
- Combination of ESG-400 and MAJ-1871 enable use of combine output.
- Combination of UHI-2 or UHI-3 and MAJ-1871 or MAJ-1872 and MAJ-1873 enable use of automatic fume control function.
- Combination of UHI-4 and MAJ-1871 or MAJ-1872 enable use of automatic fume contril function.

(7) This product has the “setting selection” function that allows the user to arrange , and various settings saved in advance can be called us easily.
(8) Its interface for PC communication enable use of the followingfunctions.(User unidentified)
- Software Upgrading
- Download and Upload of log data.

(9) The language shown on LCD can be selected from eight languages.
(10) As a result of introduction of the corporate product design, its desigh is consistent with the desighs of products in hte same generation.
(11) This product can be connected to ENDOALPHA-3 system.

3 Limitations

(1) Use this product under the supervision of a doctor at a medical facility.
(2) Do not use this product in combination with the products other than those designated by Olympus.
(3) This product should be used, transported or stored in the following environment.
1)Usage environment

Ambient temperature	10 - 40°C
Relative humidity	30 - 85%
Atmospheric pressure	70 - 106kPa
Altitude	3000m or less

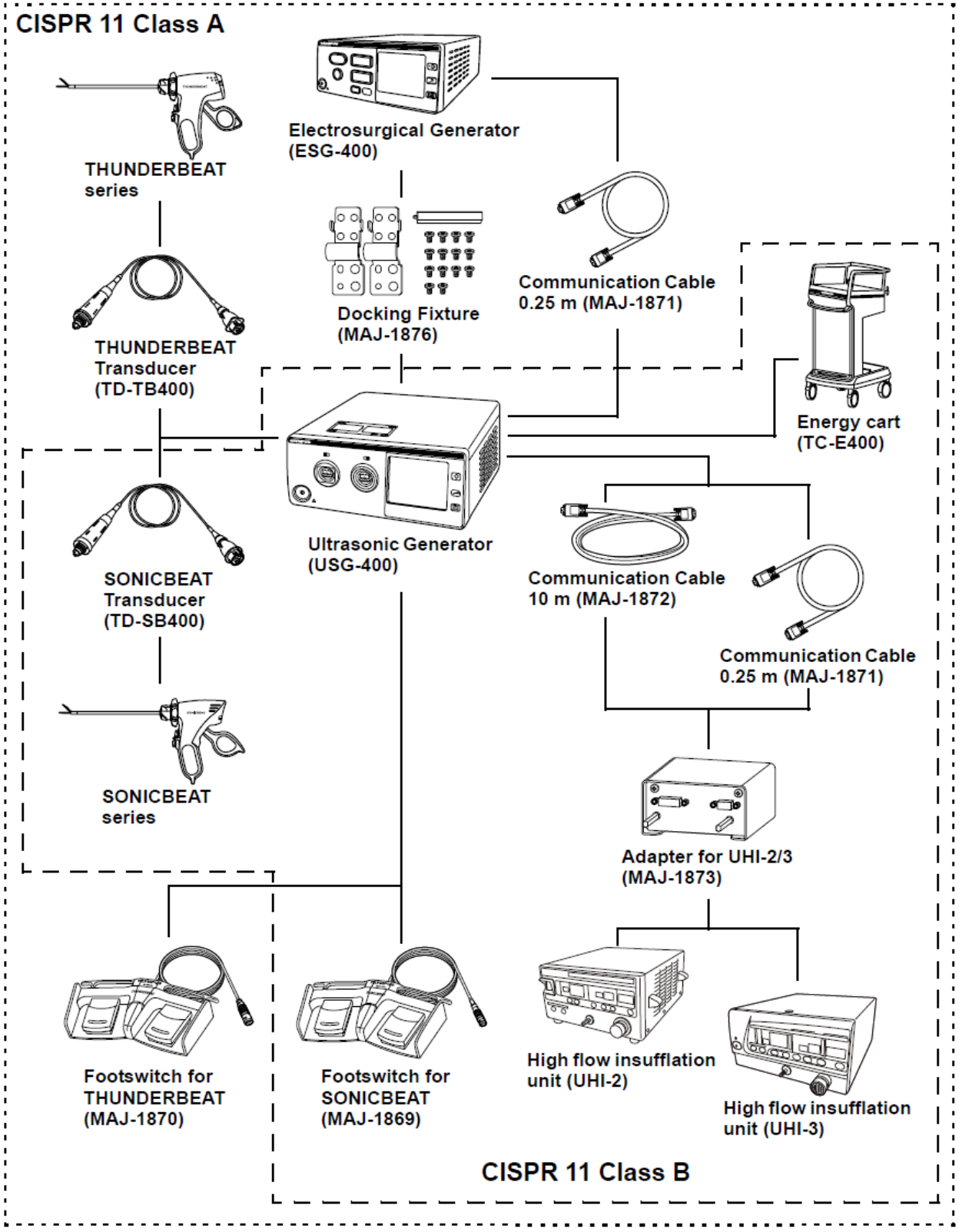
(Do not use this product in the combustible atmosphere)
2)Transportation/storage environment

Ambient temperature	-25 - 70°C
Relative humidity	10 - 90%
Atmospheric pressure	70 - 106kPa

(4) Power source
1)Voltage, current

J type	100V, 3A
A type	120V, 3A
E type	220 - 240V, 1.5A
2)Frequency	50/60Hz
3)Voltage variation	Within ±10%
4)Frequency variation	Within ±1Hz

4 System chart



When the ultrasonic generator is combined with the compatible electrosurgical generator, the EMC information shall comply with the compatible electrosurgical generator.

Chapter 2 : Specifications

1 Specifications 2-2

1 Specifications

○ Ultrasonic Generator USG-400

Power supply	**Rated voltage**	120 V AC (USA model) 220 - 240 V AC (EU model)
	Voltage fluctuation	Within ±10%
	Rated frequency	50/60 Hz
	Frequency fluctuation	Within ±1 Hz
	Rated input	360VA
	Fuse rating	4A,250VA
	Fuse size	Φ5 X 20mm
Size	**Dimensions**	375(w)X156(H)X480(D)mm
	Weight	9 kg
Classification (medical electrical equipment)	**Type of protection against electric shock**	Class I
	Degree of protection against electric shock of applied part	CF type
	Degree of protection against explosion	The ultrasonic generator should be kept away from flammable gases.
Output	**The applicable instrument**	THUNDERBEAT/SONICBEAT
	ON/OFF operation	Footswitch Handswitch
	Output setting	Setting possible in the Set Screen displayed on the touch panel.
	Frequency	47.0kHz
	Duty cycle (Recommended cycle)	1 min. ON/1min. OFF
Medical Devices Directive	CE 0197	This device complies with the requirements of Diretive 93/42/EEC concerning medical devices. Classification: Class Ⅱ b This device complies with the EMC requirements of EN 60601-1-2:2007 when used in combination with devices bearing CE marking either on the products or in its instructions for use. Emission: Class B of EN 55011
EMC	**Applied standard IEC 60601-1-2:2001 (2007)**	The ultrasonic generator complies with the standards listed in the left column. CISPR 11 of emission: Group 1,Class B The ultrasonic generator complies with the EMC standard for medical electrical equipment; edition 3(IEC 60601-1-2:2007).However, when connecting to an instrument that complies with the EMC standard for medical electrical equipment, edition 1(IEC 60601-1-2:1993), the whole system complies with edition 1. When the ultrasonic generator is combined with the compatible electrosurgical generator, the EMC information shall comply with the compatible electrosurgical generator.

WEEE Directive		In accordance with European Directive 2002/96/EC on Waste Electrical and Electronic Equipment, this symbol indicates that the product must not be disposed of as unsorted municipal waste, but should be collected separately. Refer to your local Olympus distributor for return and/or collection systems available in your country.
Year of manufacture		The last digit of the year of manufacture is given in the second digit of the serial number.

○ Footswitch for THUNDERBEAT (MAJ-1870, optional)/ Footswitch for SONICBEAT (MAJ-1869, optional)

Classification (medical electrical equipment)	**Degree of water resistance**	IEC60529 IPX8 water tight type (except the plug section)
	Degree of protection against explosion	IEC6060101AP type
Size	**Dimensions**	346(w)X64(H)X486(D)mm
	Weight	2.3 kg
	Length of the cord	4000 mm

○ Communication Cable 0.25m (MAJ-1871, optional)

Size	**Weight**	0.04kg
	Length of the cord	250 mm

○ Communication Cable 10m (MAJ-1871, optional)

Size	**Weight**	0.5kg
	Length of the cord	10,000 mm

○ Adapter for UHI-2/3 (MAJ-1873, optional)

Size	**Dimensions**	94(w)X37(H)X71(D)mm
	Weight	215 g
Applicable Cables		MAJ-1871, MAJ-1872

○ Docking Fixture (MAJ-1876, optional)

Screws	14 pcs
Hex wrench	1 pc
Ficture plates	2pcs

Chapter 3 : Installation and Connection

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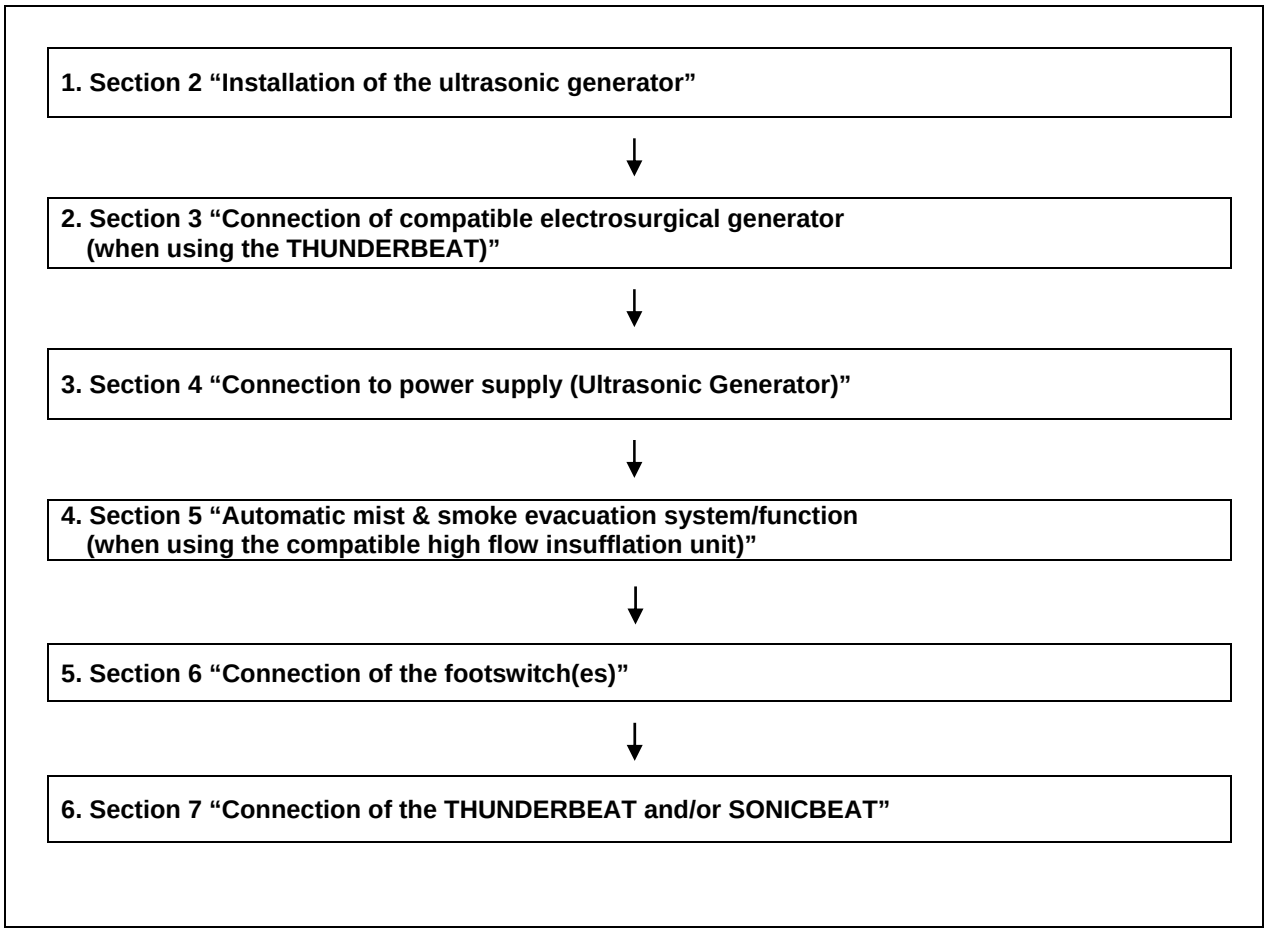
Prepare the ultrasonic generator and ancillary equipment for the intended purpose by referring to “System chart” in the Product Outline. Install and connect the ultrasonic generator and ancillary equipment as described in the following sections and also by referring to the instruction manuals for the ancillary equipment.

1 Installation workflow

The following is the equipment installation workflow. For detailson each step, read the corresponding description.


1. Section 2 “Installation of the ultrasonic generator”
2. Section 3 “Connection of compatible electrosurgical generator (when using the THUNDERBEAT)”
3. Section 4 “Connection to power supply (Ultrasonic Generator)”
4. Section 5 “Automatic mist & smoke evacuation system/function (when using the compatible high flow insufflation unit)”
5. Section 6 “Connection of the footswitch(es)”
6. Section 7 “Connection of the THUNDERBEAT and/or SONICBEAT”

2 Installation of the ultrasonic generator

CAUTION

- Heed the following cautions when installing the ultrasonic generator in a position other than on the energy cart shown in the “System chart” in the Product Outline.

  − Install the ultrasonic generator on a level, stable platform. If the ultrasonic generator slips from or topples down from an u nstable installation position, the patient, surgeon and/or surgical staff may be injured. Furthermore, equipment damage may occur.
  − Confirm that the installation position has enough strength and size for supporting the ultrasonic generator. If it is not strong enough, the ultrasonic generator may fall and be damaged.

- Be careful when the trolley (cart) containing the ultrasonic generator and other equipment are transported on a non-level surface or across an obstacle cable. If the trolley (cart) is transported over an obstacle, the ultrasonic generator and other equipment may tip over possibly resulting in equipment failure.

- Do not install the ultrasonic generator on its side or upside down. Otherwise, a failure or malfunction may occur.

- Do not install the ultrasonic generator in close contact with a wall or other equipment in a manner that would block the ventilation opening. Otherwise, the generator may overheat.

- Be careful not to pinch a hand when installing the ultrasonic generator.

- Avoid applying excessive force on the socket connections. Otherwise, wire disconnection or other failure may occur.

- Always use the ultrasonic generator in compliance with the “Operating environment” specified in the Product Outline. Otherwise, the ultrasonic generator may fail.

NOTE

- Keep the instruction manual in an easily accessible place near the ultrasonic generator.

- Before connecting an accessory to the ultrasonic generator, read And understand the instruction manual for the accessory thoroughly and confirm the compatibility of the ultrasonic generator.

1. Checking the operationg conditions
   Confirm that the operating conditions comply with the information provided in “Danger, warnings, and cautions.

2. Installing the trolley (cart)
   When using the energy cart TC-E400, prepare the cart by following its instruction manual.

3. Installing the ultrasonic generator
   Place the ultrasonic generator on a stable trolley (cart) or a level, stable platform. Use of the energy cart TC-E400 is highly recommended.

3 Connection of compatible electrosurgical generator (when using the THUNDERBEAT)

WARNING

Never connect a cable other than the optional communication cable to the ultrasonic generator. Otherwise, the ultrasonic generator cannot perform appropriately and injury or equipment damage may result.

CAUTION

- Avoid applying excessive force on the communication cable. Otherwise, wire disconnection or other failure may result.
- Be sure to retain the docking plug cover. If it is lost, the ultrasonic generator cannot be used in the standalone configuration.
- Be sure not to lose the tools such as screws and fixture plates. If these items are lost, the ultrasonic generator cannot be connected to the compatible electrosurgical generator.
- Connect the docking connector and docking plug correctly. Otherwise, malfunction or ultrasonic generator damage may result.
- Avoid getting liquid inside the ultrasonic generator. Otherwise, it may be damaged.
- Avoid applying excessive force on the docking connector, docking plug and fixture plates. Otherwise, they may be damaged.
- Heed the following cautions when assembling the docking connector and docking plug:
  − Be careful not to pinch a finger.
  − Be careful not to drop a screw in the area around the docking plug.
- Connect the docking plug to the docking connector properly. Improper connection such as oblique insertion or contamination may cause output irregularities.
- Securely fix the fixture plates on the compatible electrosurgical generator. Otherwise, the compatible electrosurgical generator may fall.
- Remove the fixture plate prior to lifting the compatible electrosurgical generator. Otherwise, the fixture plates may be damaged.
- Do not remove screws other than those screws that are instructed to do so in the manual.
- Disconnect the docking connector and/or the docking plug properly as described in “Disconnection” on page 3-10 Otherwise, the ultrasonic generator, docking connector and/or docking plug may be damaged.
- Before connecting the compatible electrosurgical generator, be sure that the power cord of the ultrasonic generator is unplugged from the AC power socket on the ultrasonic generator.
- When removing the docking plug cover, be careful to maintain pressure on the cover, because the docking plug is spring-loaded.

The THUNDERBEAT performs cutting and coagulation using high frequency (RF bipolar) and ultrasonic energy. When it is used, both the compatible electrosurgical and ultrasonic generators are required.

To transmit the high-frequency (RF bipolar) energy from the compatible electrosurgical generator to the ultrasonic generator, a docking connector and docking plug are provided on each of these generators.

To connect the two generators, align the docking connector at the bottom of the compatible electrosurgical generator into the docking plug at the top of the ultrasonic generator.

After the alignment is made, the compatible electrosurgical generator is placed on top of ultrasonic generator (see Figure 3.1).

This section describes how to connect and disconnect the docking connector and docking plug.

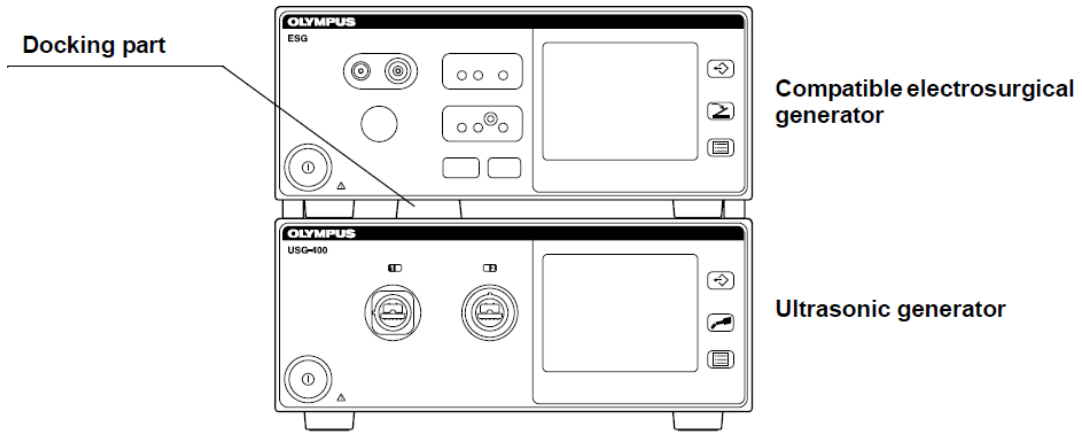


Figure 3.1

❍ Connection

1. Preparing the docking fixture
Prepare the docking fixture (MAJ-1876).

- The docking fixture includes the tools for use in connection, including 2 fixture plates, 14 screws (12 pcs for the fixture plates and 2 pcs for the docking plug cover) and a hex wrench.

- All of the screws used in the connection between the compatible electrosurgical generator and ultrasonic generator should be tightened/loosened using the hex wrench.

2. Checking the docking plug cover
Confirm the position of the docking plug cover, which is a rectangular plate on the top panel (near front) of the ultrasonic generator (see Figure 3.2).

Behind the docking plug cover is the docking plug for connection of the compatible electrosurgical generator.

3. Removing the docking plug cover
Holding the docking plug cover, remove four screws from the docking plug cover (see Figure 3.2). Retain the docking plug cover.

Removing the docking plug cover exposes the docking plug.

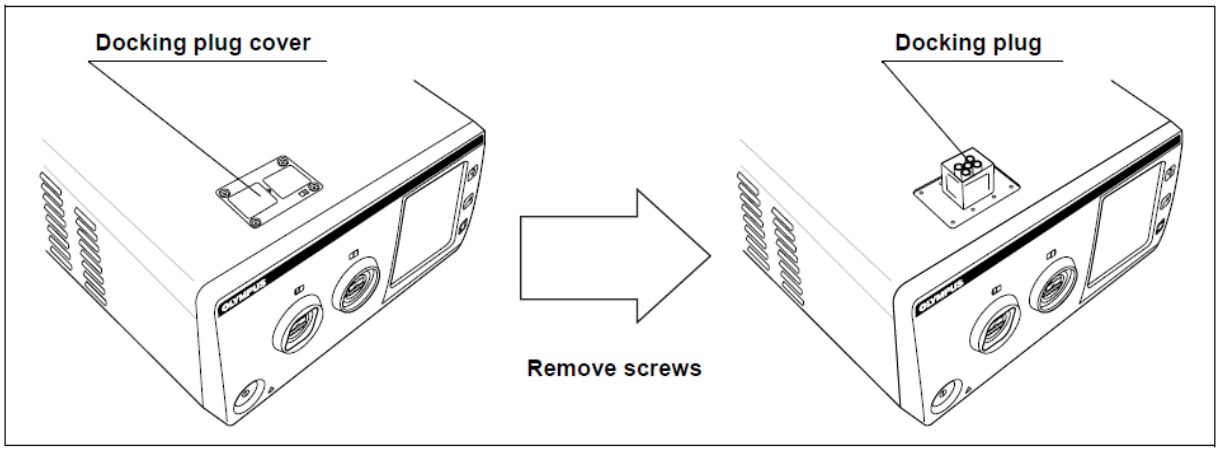


Figure 3.2

4. Securing the docking plug
Insert the screws removed in step 3 into the four positions around the docking plug and tighten securely (see Figure 3.3).

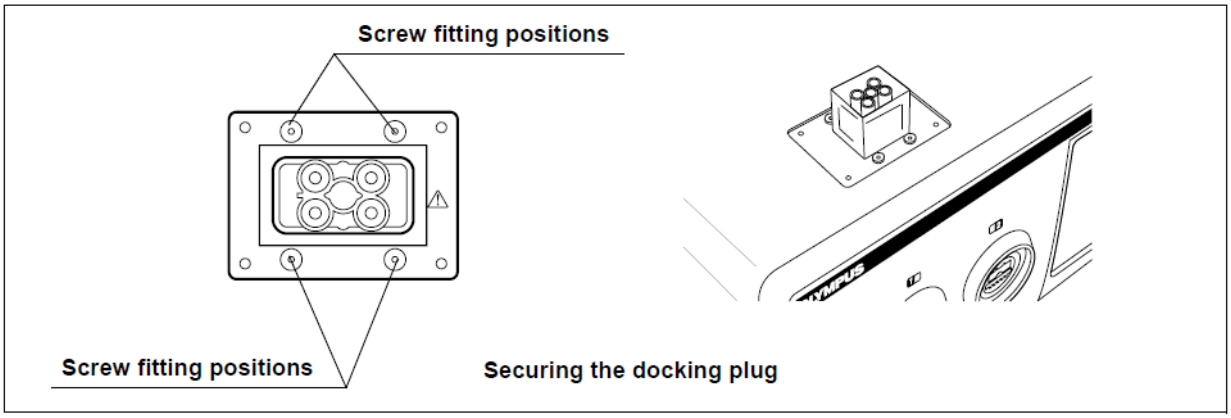
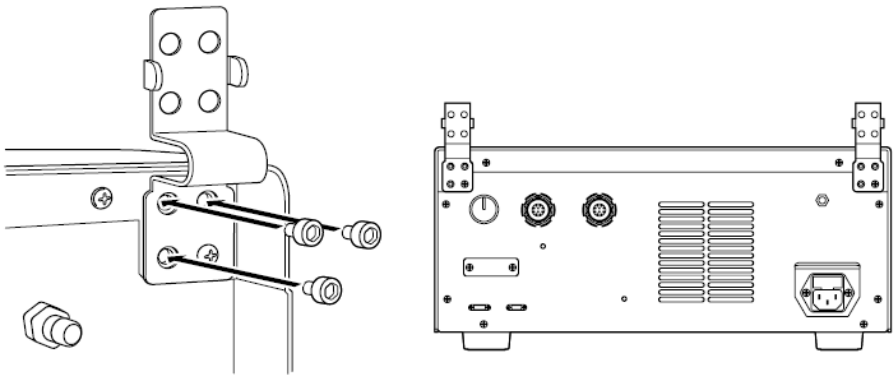


Figure 3.3

5. Attaching the fixture plates to the ultrasonic generator
Attach the fixture plates on two positions at the top left and top right of the rear panel of the ultrasonic generator using three screws for each plate (see Figure 3.4).



Attaching fixture plates to the ultrasonic generator

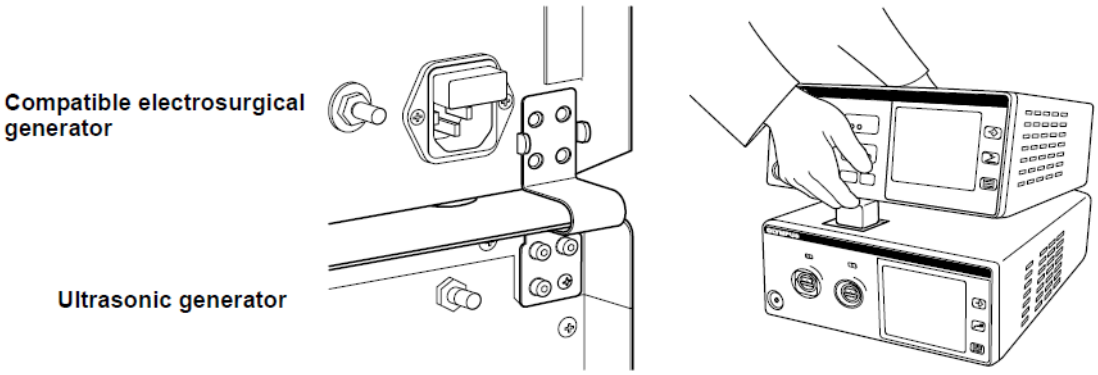
Figure 3.4

6. Connectiong

Align the rear panel of the compatible electrosurgical generator with the fixture plates and then lower the front edge of the compatible electrosurgicalgenerator slowly (see Figures 3.5 and 3.6).

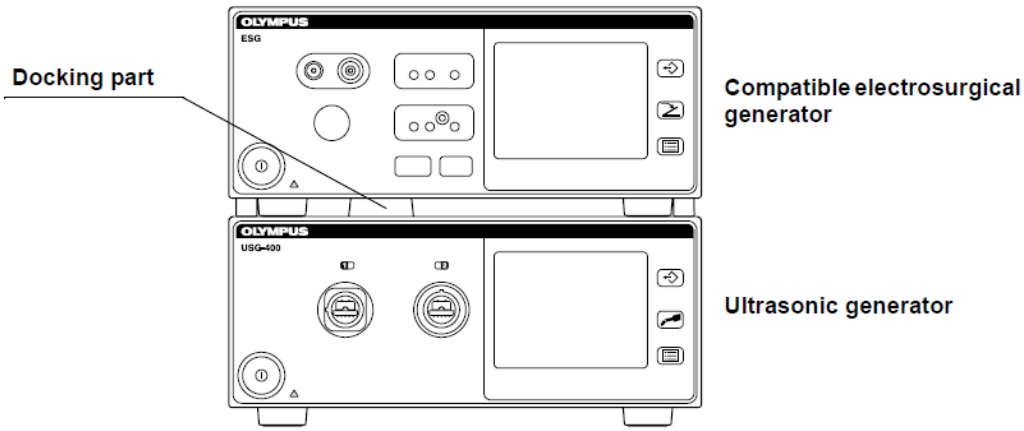
Align the compatible electrosurgical generator with the fixture plates ensures alignment of the docking plug and docking connector.

Fixture plates attached to the ultrasonic generator's rear panel



Connecting the docking connector of the compatible electrosurgical generator and the docking plug of the ultrasonic generator

Figure 3.5

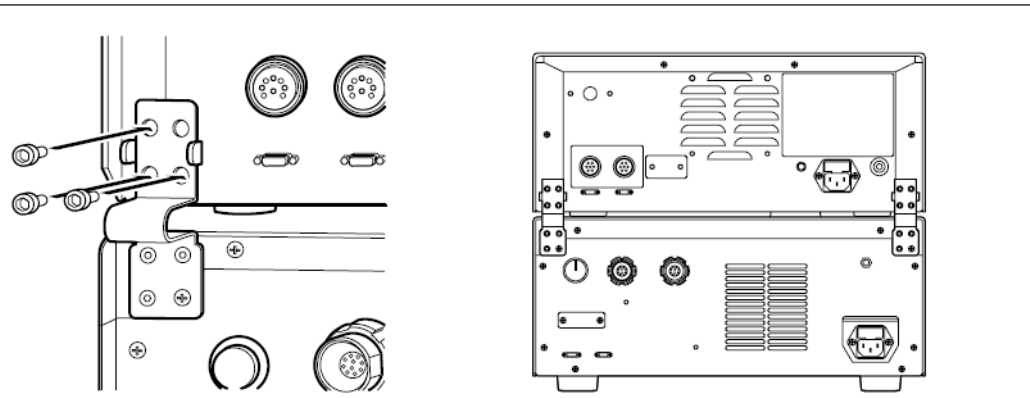


Connecting the docking connector of the compatible electrosurgical generator to that of the ultrasonic generator

Figure 3.6

7. Attaching the fixture plates to the compatible electrosurgical generator
attach the fixture plates that have been attached to the rear panel of the ultrasonic generator to the compatible electrosurgical generator using three screws for each plate (see Figure 3.7).

The fixture plates ensure tight clamping of the two generators.



Attaching fixture plates to the compatible electrosurgical generator

Figure 3.7

8. Storing the docking plug cover
Attach the docking plug cover, which has been removed in step 3 above, to the threaded holes for the docking plug cover on the rear panel of the ultrasonic generator using two screws (see Figure 3.8).

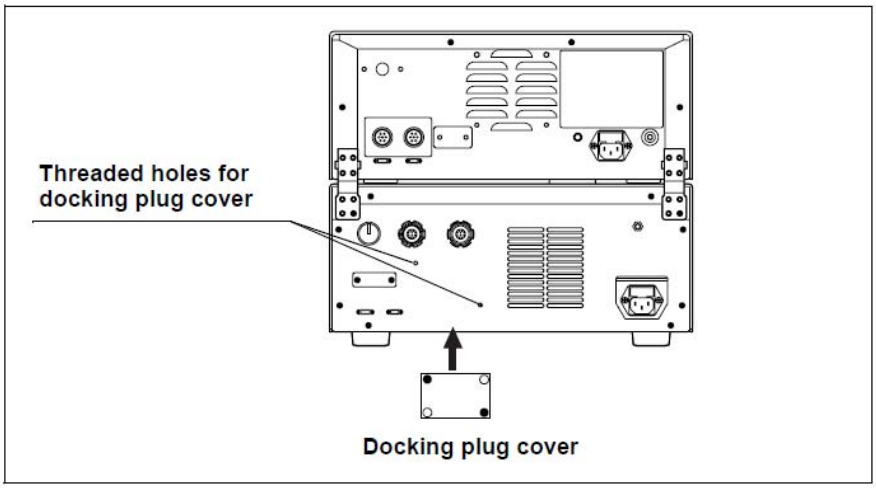


Figure 3.8

9. Storing the tool
Store the hex wrench in a nearby location such as the drawer of the cart.

10. Connecting the communication cable 0.25m
Connect the LINK-IN and LINK-OUT plugs of the communication cable 0.25 m to the communication connectors on the rear panels of the ultrasonic generator and compatible electrosurgical generator. After connection, secure each plug by pushing it in while turning the screws on both sides of the plug (see Figure 3.9).

Example: Connect the communication cable 0.25 m LINK-IN plug to the LINK-IN connector on the rear panel of the ultrasonic generator and connect the communication cable 0.25 m LINK-OUT plug on the other end to the communication connector on the rear panel of the compatible electrosurgical generator.

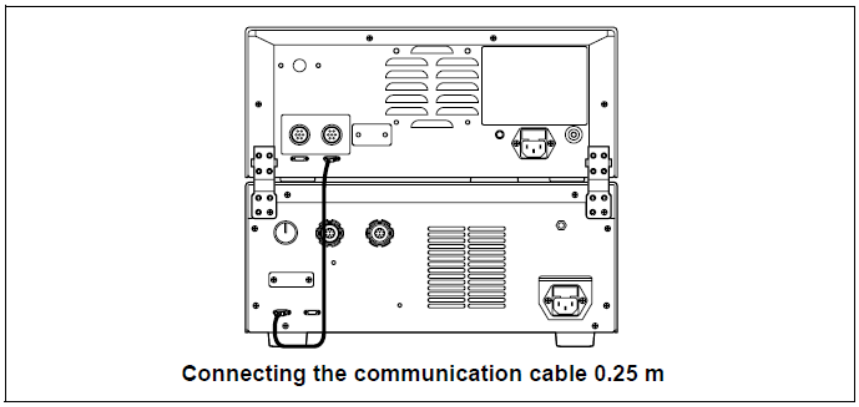


Figure 3.9

❍ Disconnection

1. Preparing the stored tool
   Prepare the hex wrench that has been stored after the connection.
   All screws used in this disconnection should be handled by the hex wrench.

2. Disconnecting the communication cable 0.25m
   Loosen the plugs of the communication cable 0.25 m connected to the rear panels of the ultrasonic generator and compatible electrosurgical generator by loosening the screws on both sides of each plug by hand, and then unplug the plugs.

3. Removing the docking plug cover
   Remove the docking plug cover from the rear panel of the ultrasonic generator.

4. Removing the fixture plates from the compatible electrosurgical generator
   remove screws from the fixture plates attached to the rear panel of the compatible electrosurgical generator.

5. Separating the generators
   Hold the front side of the compatible electrosurgical generator and lift it (see Figure 3.10).

6. Removing the docking plug screws.
   Remove screws from the four positions around the docking plug.

7. Removing the fixture plates from the ultrasonic generator.
   Remove screws from the fixture plates attached to the rear panel of the ultrasonic generator.

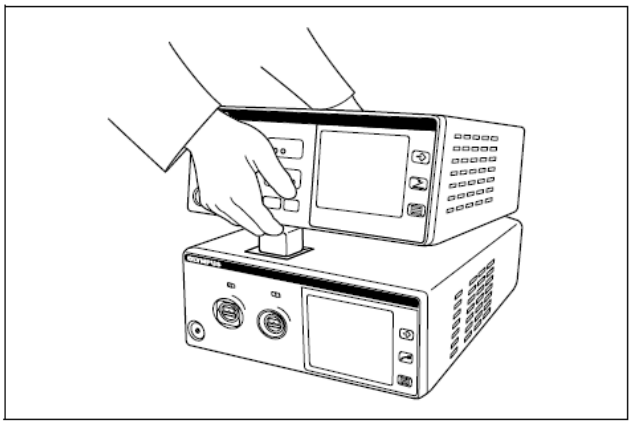


Figure 3.10

8. Secureing the docking plug
Place the docking plug cover on the docking plug and push the cover slowly with your hand to cover the docking plug (see Figure 3.11).

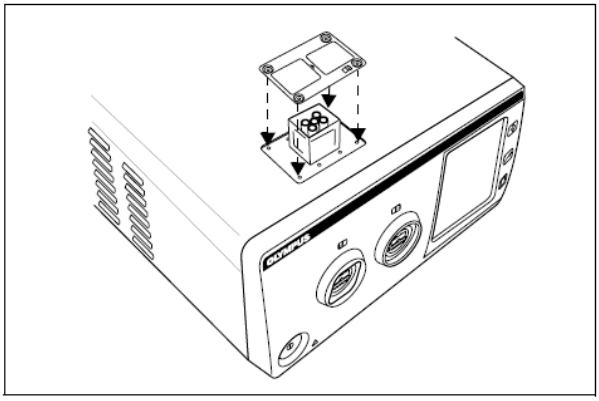


Figure 3.11

9. Secureing the docking plug cover
Attach the screws that have been removed in step 7 on the four corners of the docking plug cover.

10. Storing the parts and tools
Store the removed fixture plates X 2, screws X 14 and the hex wrench.

4 Connection to power supply (Ultrasonic Generator)

WARNING

- Connect the power cord firmly so that it is not unplugged accidentally during operation, and avoid excessive bending, straining or twisting. Otherwise, the power cord may become unplugged or damaged. If damaged, an electric shock or fire hazard may result.
- The ultrasonic generator requires grounding for safety. To avoid an electric shock, always connect the power cord plug to a properly grounded hospital-grade 3-conductor power outlet. Do not use an adapter that converts the 3-conductor power plug into a 2-conductor plug because this may impair the safety of the unit.
- Confirm that the power capacity of the hospital-grade power outlet to which the ultrasonic generator is connected is sufficient for all the equipment connected to it including the ultrasonic generator. If the power capacity of the power outlet is insufficient, a fire hazard may result and the circuit breaker of the hospital may trip, turning OFF all of the equipment connected to the power supply including the ultrasonic generator.
- Do not use an extension cord and power strip in the power supply line. Otherwise, improper installation/connection may cause an electric shock hazard.

CAUTION

Before connecting the power supply, make sure that it conforms to the power specifications described on the rating plate of the ultrasonic generator.

1. Connecting the power cord
   Connect the power cord of the ultrasonic generator to the AC power socket on the rear panel of the ultrasonic generator (see Figure 3.12).

2. Connecting to the power outlet
   Connect the power cord directly to a hospital-grade 3-conductor power outlet that meets the electrical rating inscribed on the rating plate of the ultrasonic generator (see Figure 3.12).

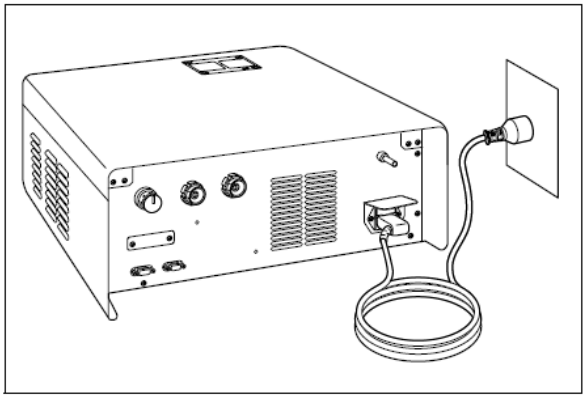


Figure 3.12

5 Automatic mist & smoke evacuation system/function (When using the compatible high flow insufflation unit)

When the THUNDERBEAT or SONICBEAT is activated, automatic mist & smoke evacuation system/function of UHI-2/3 work with activation simultaneously to evacuate the smoke and mist produced in the abdominal cavity.

CAUTION

- When using the automatic mist & smoke evacuation system/function, also refer to the instruction manual for the compatible high flow insufflation unit.
- Avoid applying excessive force to the communication cable. Otherwise, wire disconnection or other failure may result.
- The 2-way cable for aeration and extension cable for aeration are not allowed to use for the ultrasonic generator.
- When using the ultrasonic generator with the compatible electrosurgical generator and the compatible high flow insufflation unit simultaneously, contact Olympus.

1. Preparation
   Prepare the adapter for UHI-2/3 and the communication cable 10 m.

   The compatible high flow insufflation unit cannot be connected directly to the ultrasonic generator. The use of an adapter for UHI-2/3 is required for the connection.

2. Connecting the adapter for UHI-2/3
   Connect the system plug of the adapter for UHI-2/3 to the system connector on the rear panel of the compatible high flow insufflation unit. After connection, secure the system plug by fasten the screws on both sides of the plug (see Figure 3.13).

3. Connecting the communication cable 10m to the adapter for UHI-2/3
   Connect the plug of the communication cable 10 m to the LINK-IN or LINK-OUT connector of the adapter for UHI-2/3. After connection, secure each plug by pushing it in while turning the screws on both sides of the plug (see Figure 3.13).

4. Connecting the communication cable 10m (to the ultrasonic generator)
   Connect the other plug of the communication cable 10 m that has been connected to the adapter for UHI-2/3 to the LINK-IN or LINK-OUT connector of the ultrasonic generator. After connection, secure each plug by pushing it in while turning the screws on both sides of the plug (see Figure 3.13).

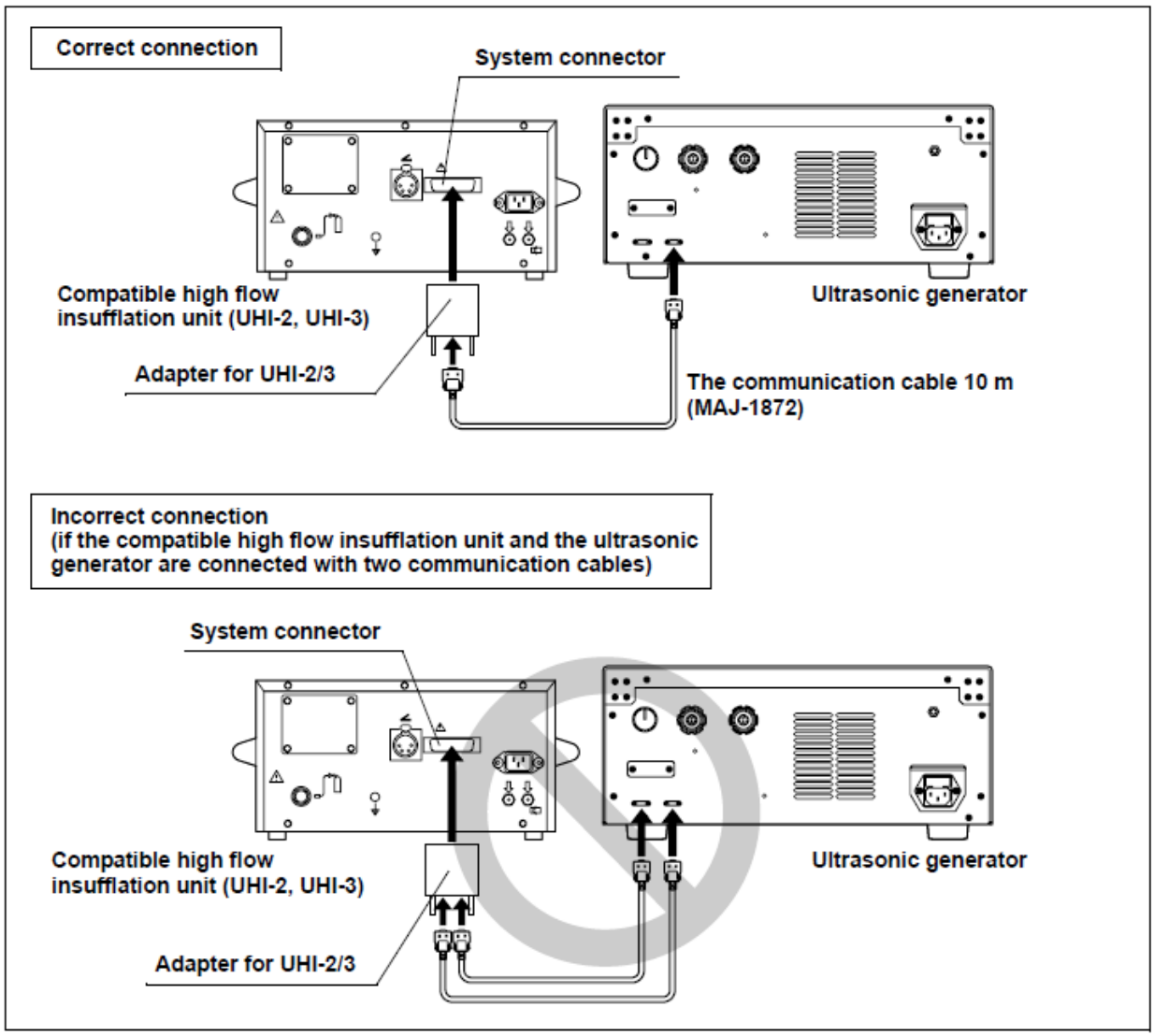

Correct connection
System connector
Compatible high flow insufflation unit (UHI-2, UHI-3)
Ultrasonic generator
Adapter for UHI-2/3
The communication cable 10 m (MAJ-1872)
Incorrect connection (if the compatible high flow insufflation unit and the ultrasonic generator are connected with two communication cables)
System connector
Compatible high flow insufflation unit (UHI-2, UHI-3)
Ultrasonic generator
Adapter for UHI-2/3

Figure 3.13

When adding the compatible electrosurgical generator to the compatible high flow insufflation unit and the ltrasonic generator.

CAUTION

- To prevent malfunction, connect either the compatible electrosurgical or ultrasonic generator to the compatible high flow insufflator. Do not connect both the compatible electrosurgical and ultrasonic generators to the insufflator at the same time.
- When connecting three devices or more, do not use two of communication cable 10 m. Otherwise, the communication may fail.

When adding the compatible electrosurgical generator to the compatible high flow insufflation unit and the ultrasonic generator that have been already connected, follow the below steps (see Figure 3.14).

1. Connecting the communication cable 0.25 m to the compatible electrosurgical generator
   Connect the plug of the communication cable 0.25 m to the LINK-IN or LINK-OUT connector of the compatible electrosurgical generator.

2. Connecting the communication cable 0.25 m to the ultrasonic generator
   Connect the other plug of the communication cable 0.25 m to the LINK-IN or LINK-OUT connector of the ultrasonic generator.

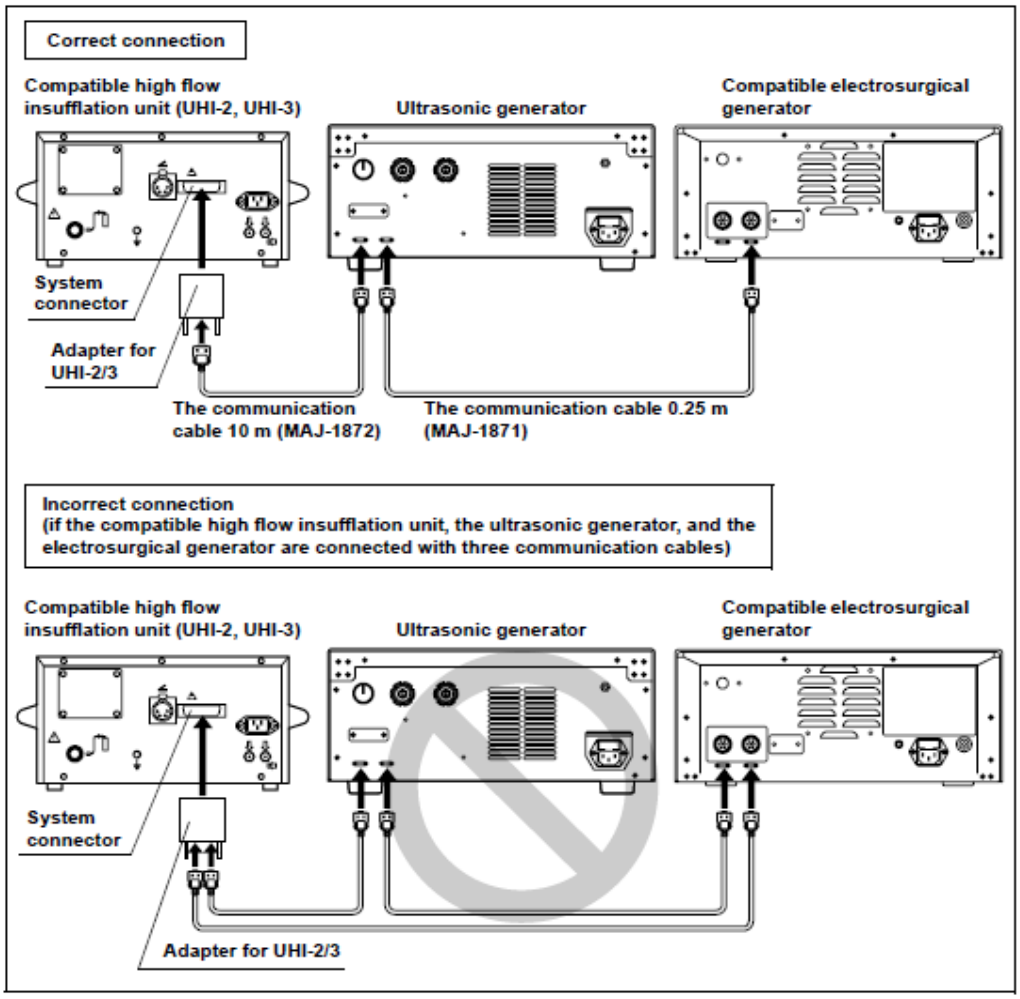

Correct connection
Compatible high flow insufflation unit (UHI-2, UHI-3)
Ultrasonic generator
Compatible electrosurgical generator
System connector
Adapter for UHI-2/3
The communication cable 10 m (MAJ-1872)
The communication cable 0.25 m (MAJ-1871)
Incorrect connection
(if the compatible high flow insufflation unit, the ultrasonic generator, and the electrosurgical generator are connected with three communication cables)
Compatible high flow insufflation unit (UHI-2, UHI-3)
Ultrasonic generator
Compatible electrosurgical generator
System connector
Adapter for UHI-2/3

Figure 3.14

6 Connection of footswitch (optional)

There are two kinds of footswitches, the THUNDERBEAT and SONICBEAT footswitches. This section describes how to connect these footswitches.

WARNING

Do not connect any equipment other than the optional footswitch to the footswitch socket. Otherwise, the system cannot perform appropriately and injury and/or equipment damage may also result.

CAUTION

- Do not place a heavy object, such as a trolley (cart), on the footswitch cable. Otherwise, cable disconnection may result.
- Do not drop to the footswitch.
- Always hold the footswitch plug section when connecting or disconnecting it. Otherwise, the cable may separate from the footswitch plug.
- Avoid applying excessive force to the cable and the end of the footswitch plug when connecting the footswitch plug. Otherwise, the cable may separate from the plug or other failure may result. If it is expected that the cable may be subject to excessive force, move the ultrasonic generator and footswitch to appropriate positions.

❍ Connection of the footswitch for THUNDERBEAT

1. Checking the footswitch
   Confirm that the footswitch cable and footswitch plug are free of damage and that the pedals are free of cracks or separation (see Figure 3.15).

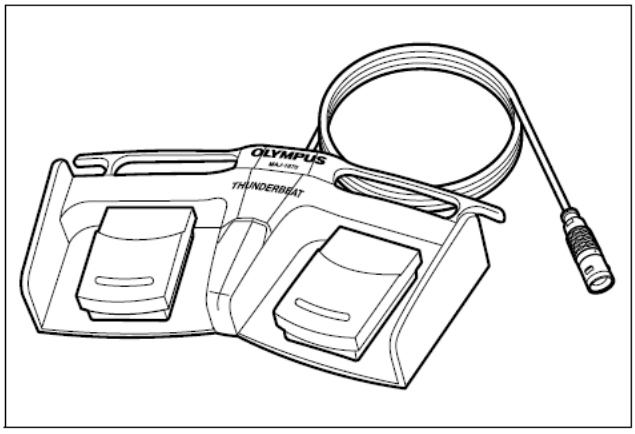


Figure 3.15

2. Checking the footswitch pedal operation
   Press each pedal and confirm that it functions smoothly.

3. Checking the position of the footswitch plug and footswitch socket
   Align the index (red circle) on the footswitch plug with the index (red circle) on the THUNDERBEAT footswitch socket (silver) on the rear panel of the ultrasonic generator (see Figure 3.16).

4. Connecting the footswitch plug
   Insert the footswitch plug all the way into the footswitch socket (as indicated by the arrow in Figure 3.16).

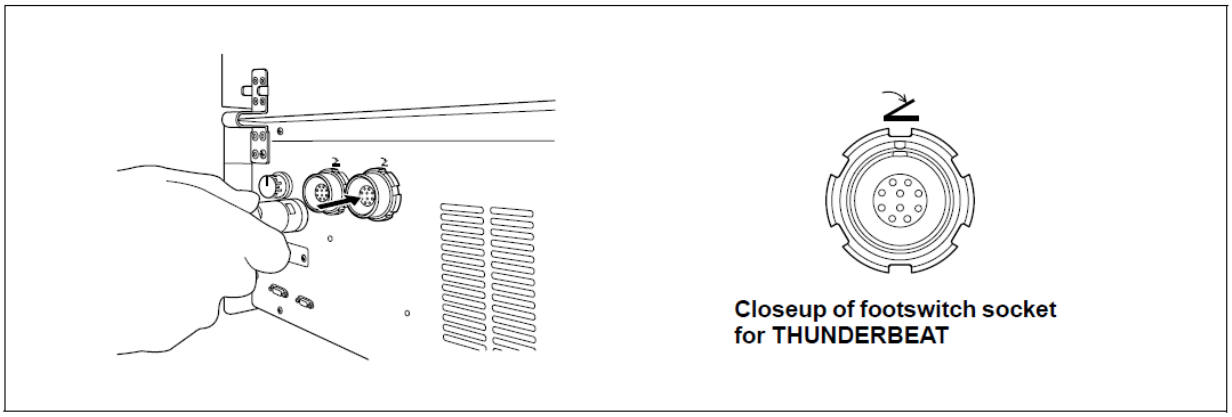


Figure 3.16

❍ Connection of the footswitch for SONICBEAT

1. Checking the footswitch
   Confirm that the footswitch cable and footswitch plug are free of damage and that the pedals are free of cracks or disengagement (see Figure 3.17).

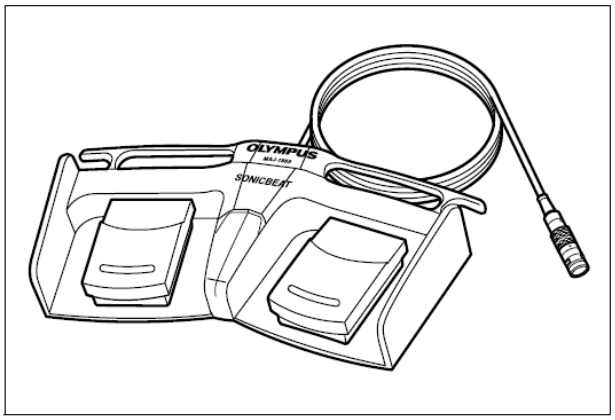


Figure 3.17

2. Checking the footswitch pedal operation
   Press each pedal and confirm that it functions smoothly.

3. Checking the position of the footswitch plug and footswitch socket
   Align the index (red circle) on the footswitch plug with the index (red circle) on the SONICBEAT footswitch socket (black) on the rear panel of the ultrasonic generator (see Figure 3.18).

4. Connecting the footswitch plug
   Insert the footswitch plug all the way into the footswitch socket (as indicated by the arrow in Figure 3.18).

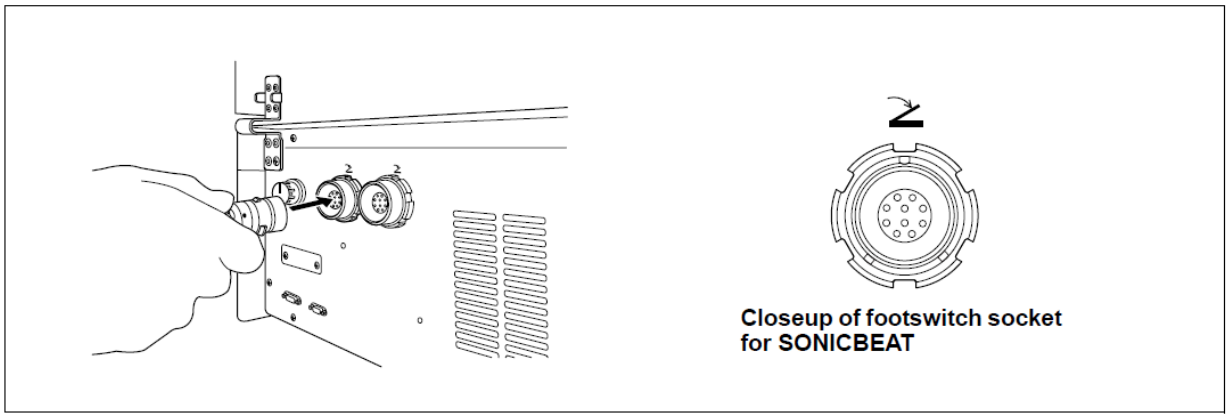


Figure 3.18

❍ Disconnecting footswitch plug

Holding the ultrasonic generator with one hand and the footswitch plug section with the thumb and index finger on the other hand, pull out the plug (see Figure 3.19).

Hold the section indicated by the arrow when unplugging the footswitch plug. The plug cannot be unplugged by pulling the section close to the footswitch cable.

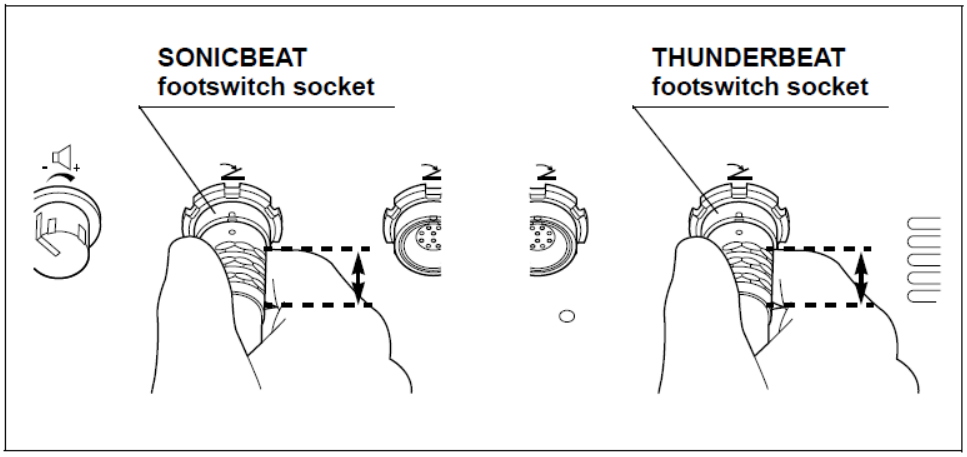


Figure 3.19

7 Connection of the THUNDERBEAT and/or SONICBEAT (various options available)

The ultrasonic generator allows you to connect THUNDERBEAT and SONICBEAT to the transducer sockets. Use either THUNDERBEAT or SONICBEAT according to the procedure to be performed and the desired tissue effect.

Connect the transducer to the THUNDERBEAT or SONICBEAT instrument before connecting it to the ultrasonic generator. For the connection of the THUNDERBEAT or SONICBEAT instrument to the transducer, refer to the instruction manual for the THUNDERBEAT or SONICBEAT to be used.

WARNING

Do not connect an instrument other than the THUNDERBEAT or SONICBEAT to the transducer socket. Otherwise, the system will malfunction and injury and/or equipment damage may also result.

CAUTION

- Do not touch the transducer plug contacts. Static electricity that was accumulated during autoclaving may cause an electric shock.
- Always hold the transducer plug when connecting or disconnecting the transducer plug to/from the ultrasonic generator. Otherwise, excessive bending, straining, twisting or crushing force may disconnect the cable.
- Be sure to fully insert the transducer plug securely. Otherwise, the unsecure connection may result in unexpected disconnection of the transducer plug, resulting in no output which could lead to potential bleeding.

❍ Connecting the THUNDERBEAT to the ultrasonic generator

1. Checking the position and symbol 1
   Confirm that the symbol 1 for THUNDERBEAT on the transducer plug and transducer socket are identical (see Figure 3.20).

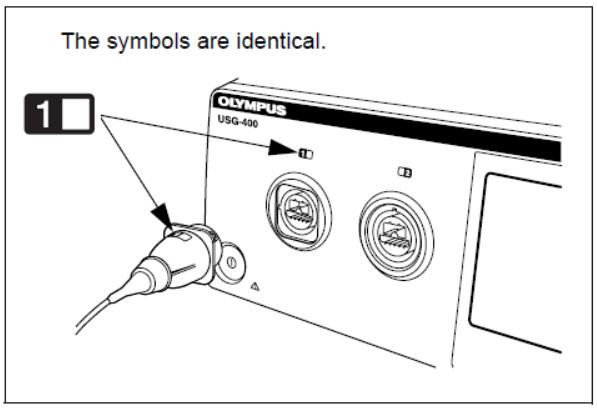


Figure 3.20

2. Connecting the transducer plug
   Fully insert the transducer plug into the transducer socket of the ultrasonic generator until it is fully seated.

❍ Connecting the SONICBEAT to the ultrasonic generator

1. Checking the position and symbol 2
   Confirm that the symbol 2 for SONICBEAT on the transducer plug and transducer socket are identical (see Figure 3.21).

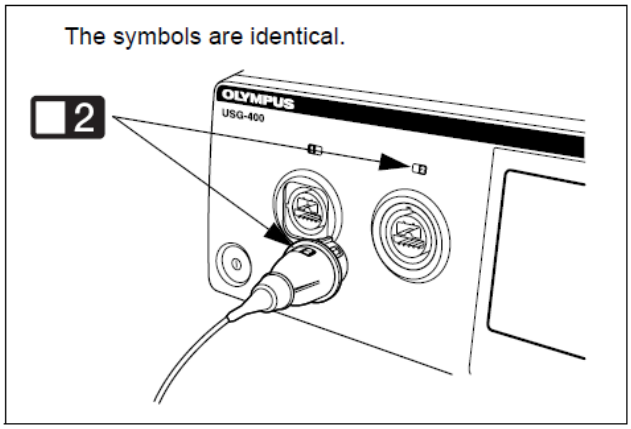


Figure 3.21

2. Connecting the transducer plug
   Fully insert the transducer plug into the transducer socket of the ultrasonic generator until it is seated.

❍ Disconnecting the THUNDERBEAT and SONICBEAT

Hold the ultrasonic generator with one hand and the transducer plug in the other hand, pull out the transducer plug.

Chapter 4 : Care, Storage, and Disposal

1 Care 4-2
2 Storage 4-3
3 Disposal 4-3

1 Care

WARNING

- After wiping the ultrasonic generator with liquid-moistened gauze, allow it to dry completely before use. Otherwise, an electric shock hazard may result.
- Be sure to wear appropriate personal protective equipment during maintenance. Otherwise, any patient blood and/or body fluids that may have contaminated the ultrasonic generator may cause infection. Personal protective equipment includes goggles, facemask, waterproof gear and chemical-resistant waterproof gloves.
- Do not spray a chemical such as disinfecting alcohol directly on the ultrasonic generator. Otherwise, the chemical penetrating it through the ventilation openings may cause a failure or malfunction.

CAUTION

- Do not clean the THUNDERBEAT/SONICBEAT sockets, other sockets and the AC power socket. Otherwise, deformation or corrosion of the contacts may cause contact failure as well as a malfunction of the ultrasonic generator and accessories.
- Do not soak the ultrasonic generator in water or sterilize it with autoclaving or gas. Otherwise, a malfunction of the ultrasonic generator may result.
- Do not wipe the exterior with an abrasive cloth, etc. Otherwise, the exterior surface will be scratched.

After using the ultrasonic generator, immediately clean it using the following steps. If cleaning is delayed, the organic dirt may solidify and become difficult to remove. Clean the ultrasonic generator periodically.

1. Turning the ultrasonic generator OFF
When using the THUNDERBEAT, turn the ultrasonic generator OFF first, then turn OFF the compatible electrosurgical generator.

- The switch is no longer illuminated.
- The touch panel is no longer illuminated.
- The push button is no longer illuminated.

2. Removing the THUNDERBEAT and/or SONICBEAT and communication cables
Disconnect the THUNDERBEAT and/or SONICBEAT and communication cables from this ultrasonic generator.

3. Unplugging the power cord
Unplug the power cord from the hospital-grade power outlet.

4. Cleaning
Remove dirt, dust and stains from the ultrasonic generator and disinfect its surface using gauze moistened with disinfecting alcohol.

If blood and/or bodily fluids contaminate the ultrasonic generator, remove them using gauze moistened with a neutral detergent solution.

5. Drying
After wiping with disinfecting alcohol, be sure to dry the ultrasonic generator completely prior to use.

2 Storage

CAUTION

- Do not store the ultrasonic generator in a place that is exposed to direct sunlight, X-rays, radioactivity or strong electromagnetic waves (e.g., the vicinity of a microwave therapeutic device, short-wave therapeutic device, MRI, wireless set, cellular phone, etc.). Also avoid storing in places of high temperatures, high humidity and where moisture/water is present. Otherwise, the instrument may be damaged and/or could present an infection control risk.
- Do not apply excessive force to the transducer cord by bending, straining or twisting it too much. Otherwise, the damaged cord may cause malfunction.
- Do not subject the ultrasonic generator to strong impacts during storage. Doing so will damage the ultrasonic generator.

1. Store location
Place the ultrasonic generator in a level posture on a stable surface. When it is not placed on the energy cart.

2. Storge environment
Store the ultrasonic generator properly in a clean, dustless place in compliance with the environmental conditions given in “Specifications” in the Specifications.

3 Disposal

When disposing of the ultrasonic generator, be sure to observe your national and local laws and guidelines.

Chapter 5 : Inspection

1 Verification workflow 5-2
2 Power verification 5-3
3 Verification of communication cable connection between compatible electrosurgical generator and ultrasonic generator (when using the THUNDERBEAT) 5-6
4 Verification of touch-screen and push buttons 5-7
5 Verification of the THUNDERBEAT and/ or SONICBEAT.....5-10
6 Verification of footswitch connection.....5-13
7 Verification of the high-frequency(RF bipolar) output (when using the THUNDERBEAT) 5-13
8 Verification of the alarm system 5-17
9 Procedure after verification 5-19
10 Inspection check sheet.....5-20

WARNING

Always inspect the ultrasonic generator as described in this chapter before using. Also, inspect the ancillary equipment used in combination with the ultrasonic generator according to the instruction manuals. Should any irregularity be observed, do not use the ultrasonic generator and take proper measures by referring to Chapter 8 "Troubleshooting". If the irregularity is still not resolved, do not use the ultrasonic generator and contact Olympus. Using irregular equipment may cause a malfunction and may also result in an electric shock, burns and/or fire hazard.

Prepare the ultrasonic generator and ancillary equipment for the surgical procedure by referring to "System chart" in Product Outline. Inspect the ultrasonic generator and ancillary equipment by referring to the respective instruction manuals.

1 Verification workflow

The following is the equipment inspection workflow. For details on each step, read the corresponding description.

1. Section 2 "Power verification"

↓

2. Section 3 "Verification of communication cable connection between compatible electrosurgical generator and ultrasonic generator (when using the THUNDERBEAT)"

↓

3. Section 4 "Verification of touch-screen and push buttons"

↓

4. Section 5 "Vertification of the THUNDERBEAT and/or SONICBEAT connection(s)"

↓

5. Section 6 "Vertification of footswitch connection"

↓

6. Section 7 "Vertification of the high-frequency(RF bipolar) output (when using the THUNDERBEAT)"

↓

7. Section 8 "Vertification of the alarm system"

↓

8. Section 9 "Procedure after verification"

2 Power verification

WARNING

- Confirm that the power switch, touch-screen and push buttons illuminate when the ultrasonic generator is turned ON. If not, check that the power cord is connected properly. If they still do not illuminate and turn the power switch to OFF, unplug the power cord and contact Olympus. Continuing the use of the ultrasonic generator in this condition may result in a fire or electric shock hazard.

- Confirm that the start tone sounds when the ultrasonic generator is turned ON. If the procedure is started without confirming the start tone, unexpected burns, bleeding or perforation may result. If the start tone does not sound, contact Olympus.

CAUTION

When using THUDNERBEAT, turn the compatible electrosurgical generator ON before the ultrasonic generator. Otherwise, an error tone will be generated.

Checking the illumination of power switch, touch-screen, and push buttons

Depress the power switch of the ultrasonic generator (see Figure 5.1).

- The periphery of the switch lights green.
- The touch-screen is illuminated.
- The push buttons is illuminated.

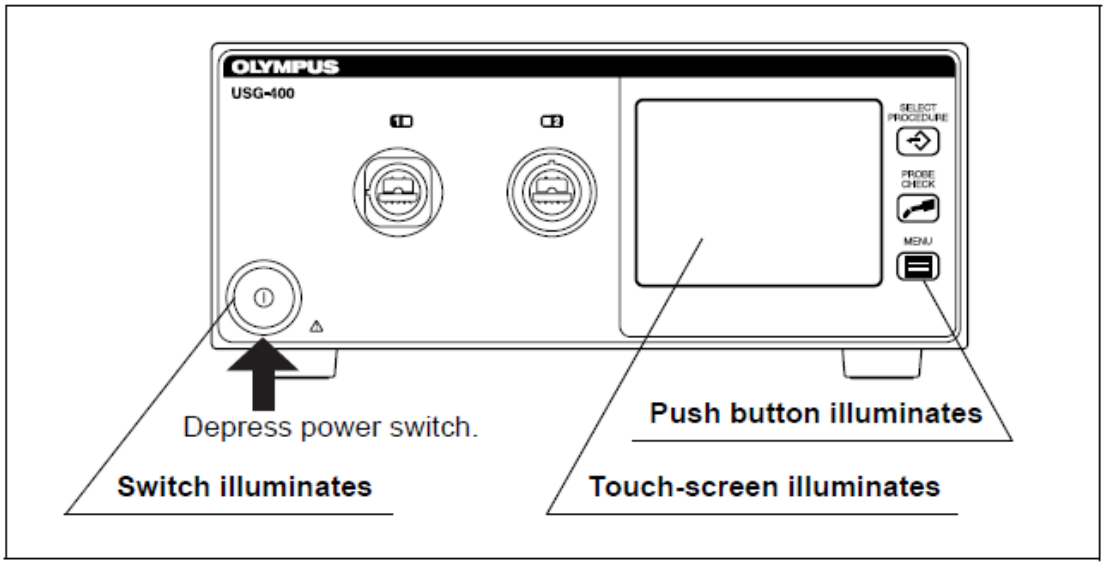


Figure 5.1

Checking the start screen and start tone

- Confirm that the “start screen” is displayed for 3 seconds on the touch-screen (see Figure 5.2).
- Confirm that the start tone sounds at the same time that the “start screen” is displayed.

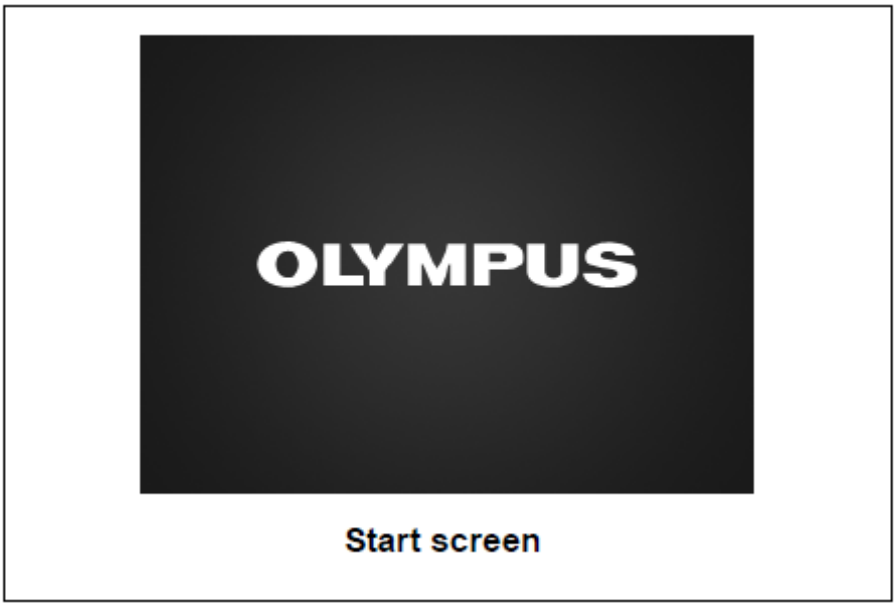


Figure 5.2

Checking the touch-screen display

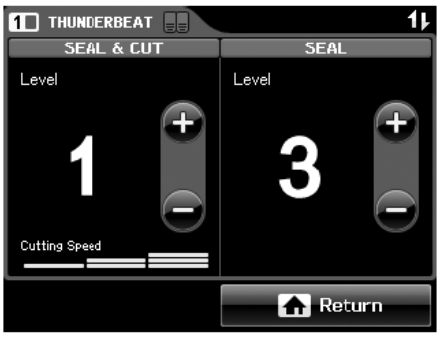
Confirm that the “Set screen” or “All screen” is displayed after “start screen”

- The displayed screen varies depending on whether one or two THUNDERBEAT and SONICBEAT are connected (see Table 5.1).
- When either THUNDERBEAT or SONICBEAT is connected, the touch-screen displays the “Set screen” for the connected THUNDERBEAT or SONICBEAT (see Figure 5.3).
- When the two THUNDERBEAT and SONICBEAT are connected, the touch-screen displays the “All screen”, in which the “THUNDERBEAT button” and “SONICBEAT button” are shown (see Figure 5.4).

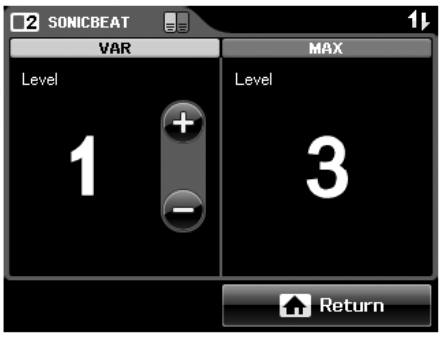
	Either THUNDERBEAT or SONICBEAT connected	**THHUNDER and SONICBEAT connected**
Displayed screen	Set screen for the connected THUNDERBEAT or SONICBEAT	All screen in which the THUNDERBEAT and SONICBEAT buttons are shown

Table 5.1 Relationship between THUNDERNBEAT and/or SONICBEAT and screen display

Set screen display when either THUNDERBEAT or SONICBEAT is connected



Only THUNDERBEAT connected



Only SONICBEAT connected

Figure 5.3

All screen display when THUNDERBEAT and SONICBEAT are connected

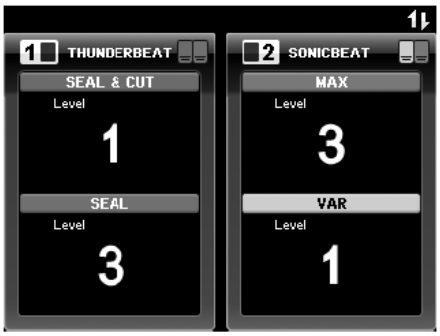


Figure 5.4

3 Verification of communication cable connection between compatible electrosurgical generator and ultrasonic generator (when using the THUNDERBEAT)

When the communication indicator is illuminated

The lighting indicates that the communication status is normal (see Figure 5.5)

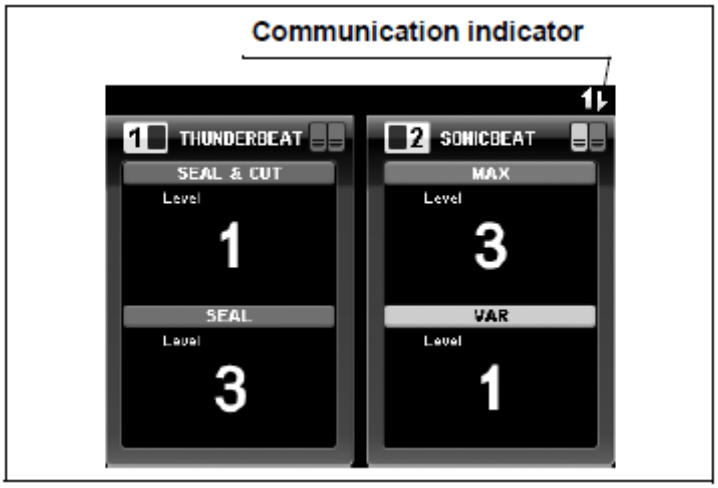


Figure 5.5

If the communication indicator is not illuminated

The communication cable 0.25 m between the compatible electrosurgical generator and ultrasonic generator is not connected properly.

1. Confirm that the communication cable 0.25 m is connected properly to the generators.

2. Confirm that the power switches of the compatible electrosurgical and ultrasonic generators are set to ON. If the power switches are not ON turn the compatible electrosurgical generator ON first, then turn ON the ultrasonic generator.

   If the communication indicator is not illuminated even after the above check, contact Olympus.

4 Verification of touch-screen and push buttons

The touch-screen displays generator control buttons.

CAUTION

- To prevent malfunction, do not press more than one part on the touch-screen simultaneously.
- Do not touch the touch-screen from the oblique direction. Otherwise, the touch-screen may cause an incorrect adjustment.
- Unintended contact with the touch-screen may cause unintended setting changes. Before activating energy output confirm that the current setting is correct.
- To prevent malfunction or damage to the touch-screen, do not press the surface excessively.
- Do not control the touch-screen with a pointed object (such as tweezers or pen). Otherwise, damage may result.
- Dirt and dust between the touch-screen and front panel may cause malfunction of the touch-screen. To prevent this, keep the touch-screen clean.
- After pressing the “Plus or Minus button”, confirm that the output level is changed accordingly. Otherwise, unintended output may result.

Checking the touch-screen operation

1. When either THUNDERBEAT or SONICBEAT is connected
   Displayed screen: Set screen.

Press the “Plus or Minus button” (see Figure 5.6).

- Pressing the “Plus button” increases the output level.
- Pressing the “Minus button” decreases the output level.
- Pressing and holding the “Plus or Minus button” varies the output level continuously.

2. Press the “Return button” on the bottom right of the screen (see Figure 5.6).
   The screen changes from the “Set screen” to the “All screen”.

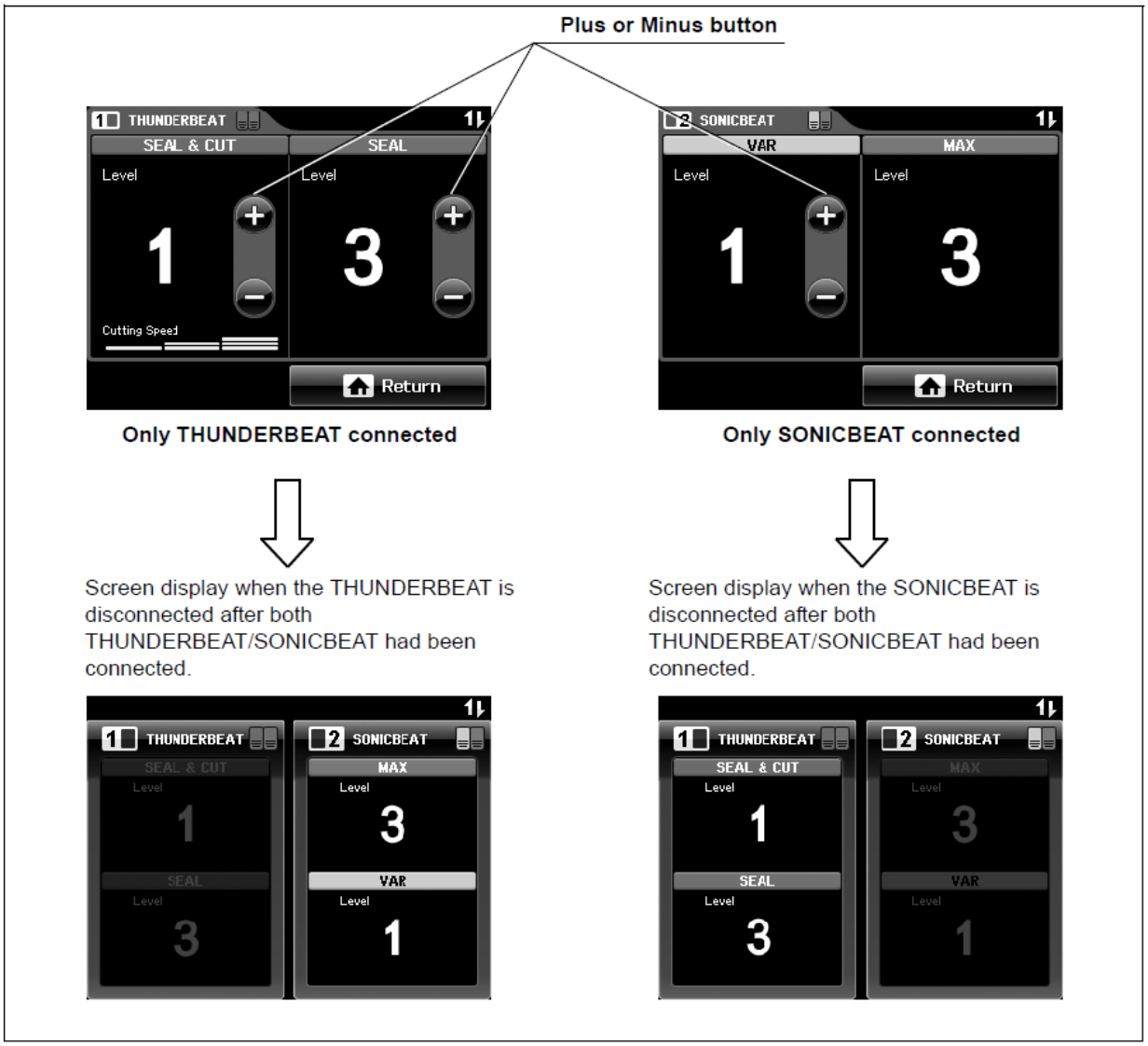


Figure 5.6

❍ When THUNDERBEAT and SONICBEAT are connected
Display screen: All screen

1. Press the “THUNDERBEAT or SONICBEAT button” on the screen (see Figure 5.7)

The screen changes from the “All screen” to the “Set screen”

2. Press the “Plus or Minus button” (see Figure 5.7).

- Pressing the “Plus button” increases the output level.
- Pressing the “Minus button” decreases the output level.
- Pressing and holding the “Plus or Minus button” varies the output level continuously.

3. Press the “Return button” on the bottom right of the screen (see Figure 5.7).

The screen changes from the “Set screen” to the “All screen”.

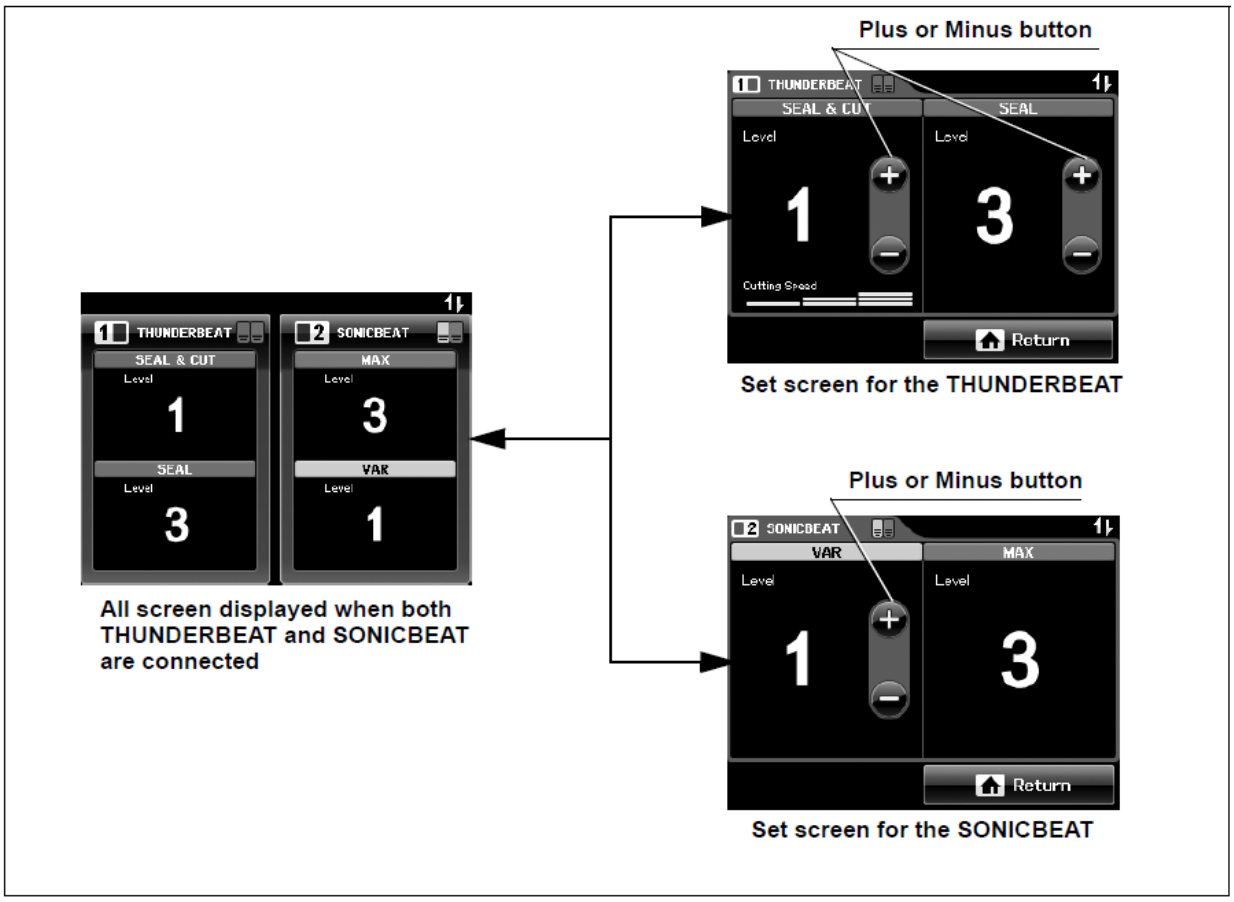


Figure 5.7

Checking the push button operations

1. Press the “PROBE CHECK push button” (see Figure 5.8).

   The “All screen” displays the confirmation window (Probe Check).

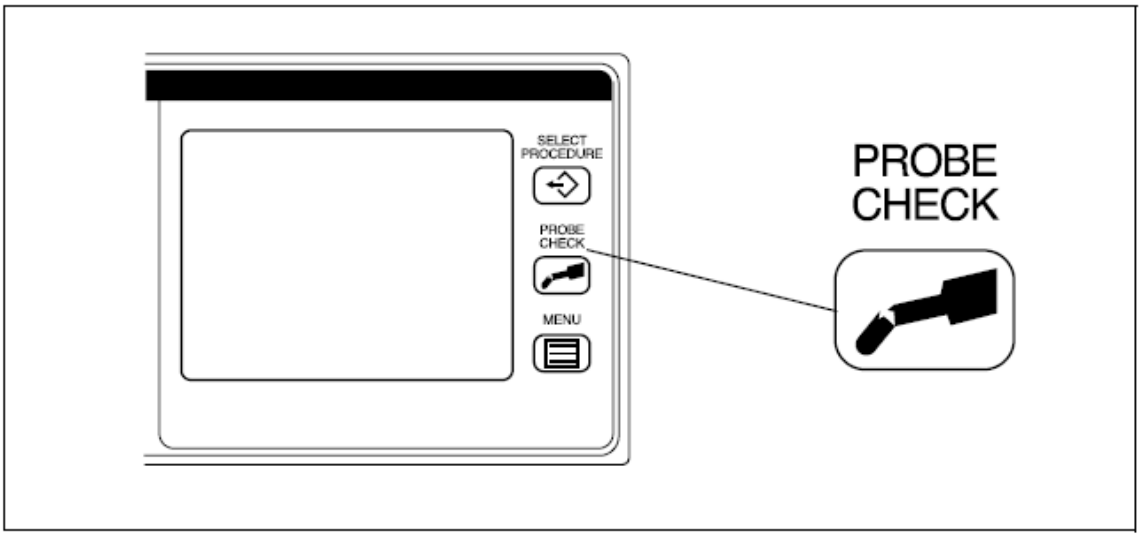


Figure 5.8

2. Press the “Cancel button” on the bottom left of the screen (see Figure 5.9).

The confirmation window (probe check) disappears and the “All screen” is displayed again.

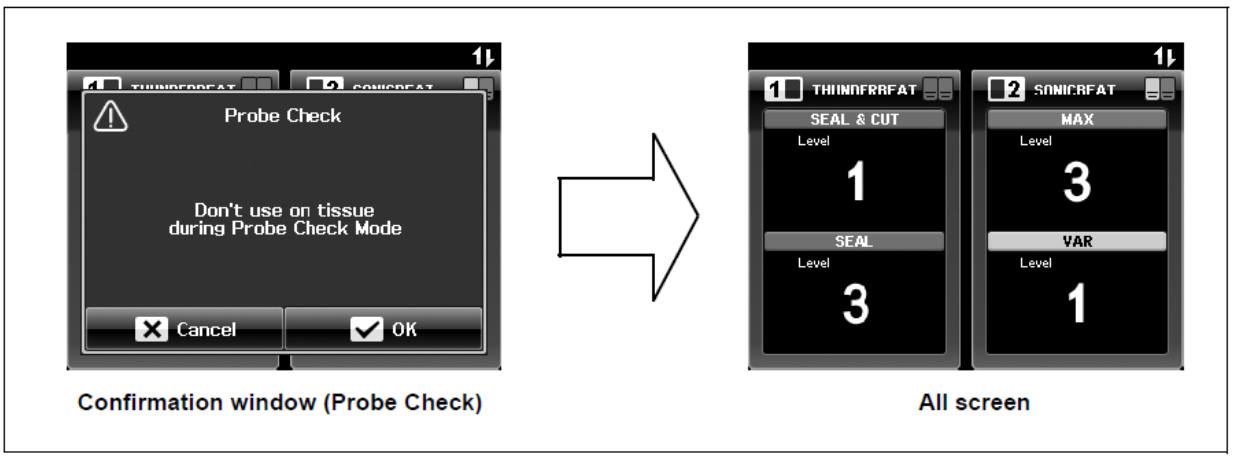


Figure 5.9

5 Verification of the THUNDERBEAT and/ or SONICBEAT

The connection status of the THUNDERBRAT or SONICBEAT can be checked by the touch-screen display after the ultrasonic generator is turned ON. Note that, however, the displayed screen differs depending on whether one single THUNDERBEAT or SONICBEAT is connected or both THUNDERBEAT and SONICBEAT instruments are connected.

WARNING

After the transducer plug is connected to the ultrasonic generator and the ultrasonic generator is turned ON, the generator touch-screen will show the same symbol that is indicated on the transducer plug. If these symbols are not identical, the ultrasonic generator or transducer may malfunction. If this occurs, immediately stop using the system and contact Olympus.

Verify the symbol for the connected THUNDERBEAT and / or SONICBEAT

❍ When either THUNDERBEAT or SONICBEAT is connected Displayed screen: Set screen

After turning the ultrasonic generator ON, confirm that the “Set screen” for the appropriate connected THUNDERBEAT or SONICBEAT is displayed.

The symbols on the connected THUNDERBEAT or SONICBEAT and displayed on the touch-screen must be identical.
The displayed name of the THUNDERBEAT or SONICBEAT on the touch-screen must match the type of the THUNDERBEAT or SONICBEAT connected (see Figure 5.10).

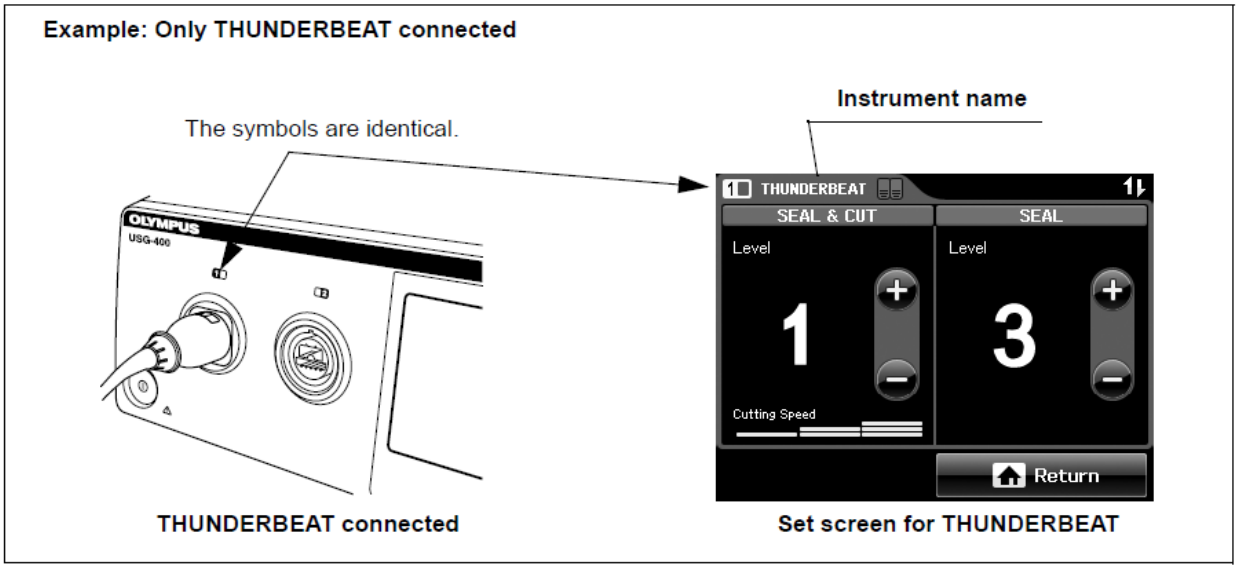


Figure 5.10

❍ When both THUNDERBEAT and SONICBEAT are connected Displayed screen: All screen

After turning the ultrasonic generator ON, confirm that the “THUNDERBEAT and SONICBEAT buttons” are illuminated on the “All screen” (see Figure 5.11).

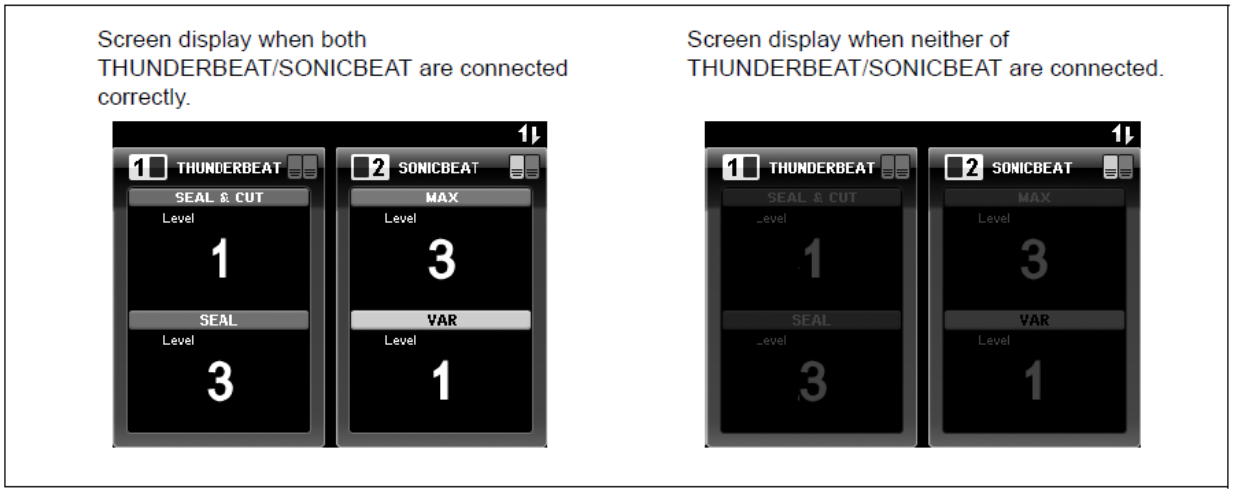


Figure 5.11

❍ When the other THUNDERBEAT or SONICBEAT is added Displayed screen: changing from Set screen to All screen

1. Connect the other THUNDERBEAT or SONICBEAT.

2. Confirm that the touch-screen shows the “All screen” that illuminates “THUNDERBEAT and SONICBEAT buttons”.

   The displayed “Set screen” changes to the “All screen” at the moment the other THUNDERBEAT or SONICBEAT is connected (see Figure 5.12).

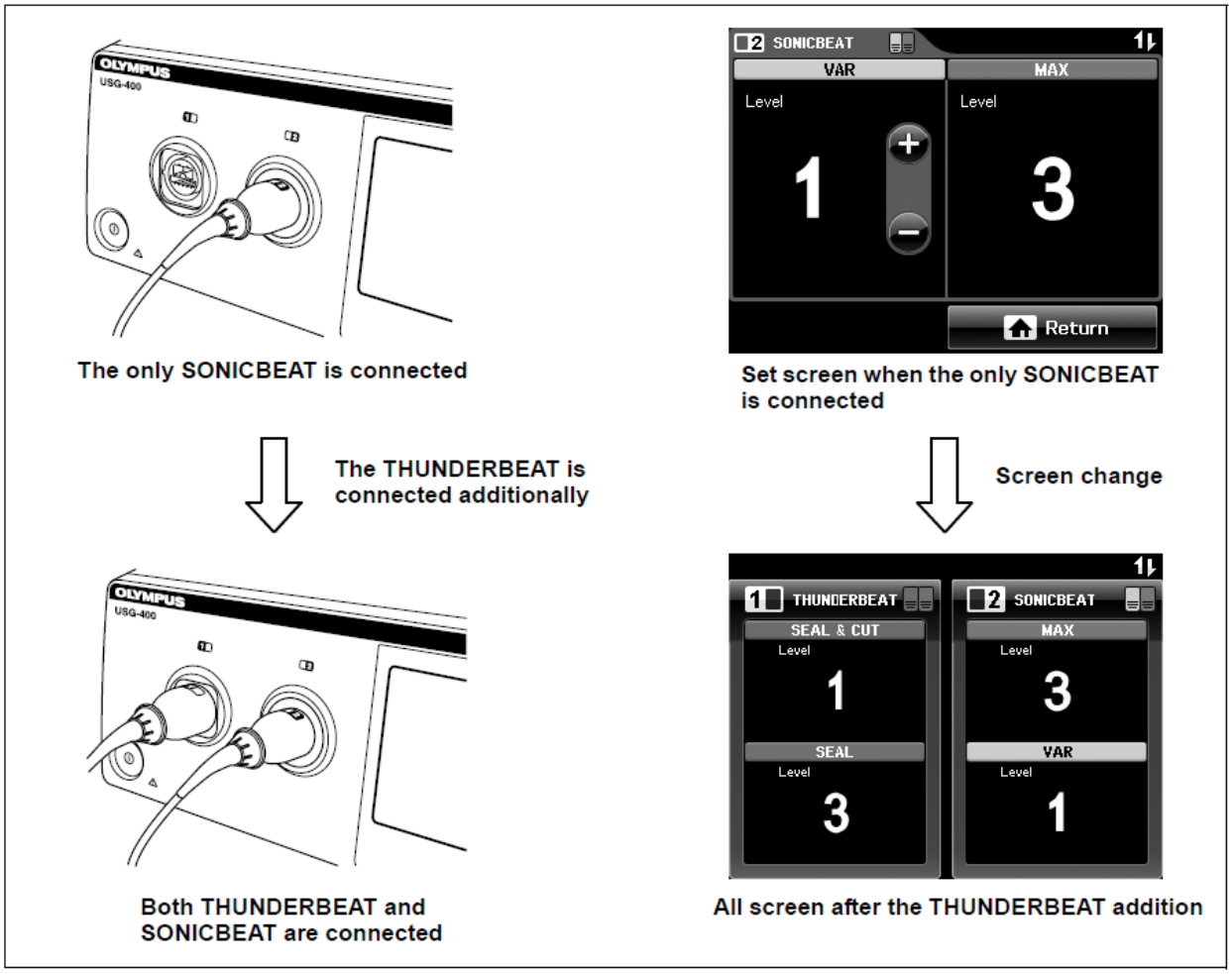

OLYMPUS
USG-400
The only SONICBEAT is connected
2 SONICBEAT
1
VAR
MAX
Level
Level
1
3
Return
Set screen when the only SONICBEAT is connected
The THUNDERBEAT is connected additionally
Screen change
OLYMPUS
USG-400
Both THUNDERBEAT and SONICBEAT are connected
1
1 THUNDERBEAT
2 SONICBEAT
SEAL & CUT
MAX
Level
Level
1
3
SEAL
VAR
Level
Level
3
1
All screen after the THUNDERBEAT addition

Figure 5.12

6 Verification of footswitch connection

The connection status of the footswitch can be checked by confirming the footswitch indicator is illuminated on the touch-screen after the ultrasonic generator is turned ON. Note that, however, the displayed screen differs depending on whether one single THUNDERBEAT or SONICBEAT is connected or both THUNDERBEAT and SONICBEAT are connected.

Checking the illumination of footswitch indicator(s)

Confirm that the footswitch indicator connected to the ultrasonic generator is illuminated (see Figure 5.13).

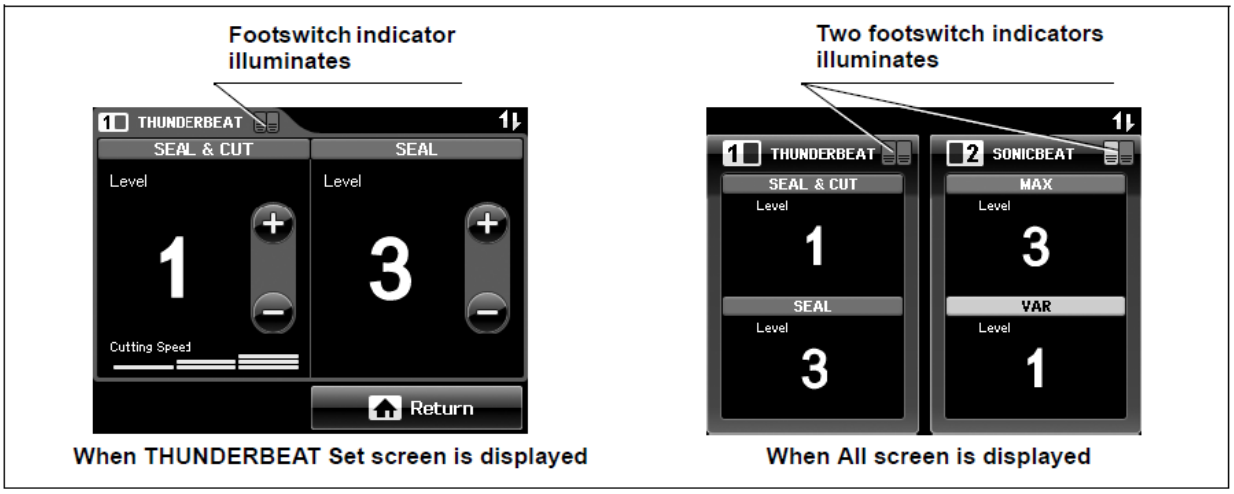


Figure 5.13

7 Verification of the high-frequency(RF bipolar) output (when using the THUNDERBEAT)

Check the presence of output by pressing the THUNDERBEAT handswitch or the pedal on the footswitch for THUNDERBEAT. Note that the displayed screen differs depending on whether one single THUNDERBEAT or SONICBEAT is connected or both THUNDERBEAT and SONICBEAT are connected.

WARNING

- The output should always be inspected outside the body cavity. Otherwise, tissues may be burnt.
- Verify the high-frequency (RF bipolar) energy delivery before surgery. Otherwise, the THUNDERBEAT may not function properly during the surgery.
- For inspecting the output in SEAL mode, do not press the SEAL & CUT button (purple) of handswitch or the SEAL & CUT pedal (left pedal: purple) of the footswitch accidentally. Otherwise, the gauze will be cut by the friction of the grasping section (jaws) and the probe tip. This may result in the grasping section wearing prematurely and/or damage to the probe tip which could result in the tip breaking.

CAUTION

- Do not touch the probe tip during output. Otherwise, the high-frequency (RF bipolar) current may cause burns.
- If the output tone does not sound or the output screen is not displayed even when the handswitch or footswitch pedal is pressed, immediately stop using the system and turn the system OFF. The ultrasonic generator, the THUNDERBEAT or footswitch may be defective. Take proper measures as instructed in Chapter 8, “Troubleshooting”. Continuing the use of the ultrasonic generator in this condition may result in burns of the surgeon, surgical staff and/or patient.
- If the output tone does not cease to sound even when the handswitch or footswitch pedal is pressed, immediately stop using the system and turn the system OFF. The ultrasonic generator, the THUNDERBEAT or footswitch may be defective. Take proper measures as instructed in Chapter 8, “Troubleshooting”. Continuing the use of the ultrasonic generator in this condition may result in burns of the surgeon, surgical staff and/or patient.
- Do not touch the container with the probe or grasping section during activation. Also, do not fully submerge the grasping section in saline, otherwise an error window could be displayed along with an error tone.
- If an error window is displayed together with an error tone during the inspection of the output, remove any remaining saline from the probe tip and the grasping section with dry, sterile gauze. Then, retry the verification submerging the tip in saline correctly.
- If you retry the verification and the window and tone persist, stop using the system and take remedial measures by referring to Chapter 8, “Troubleshooting” in the instruction manual for the ultrasonic generator.

Verifying the output level

Confirm that the output level matches the procedure to be performed.

- If the output level is erroneous, press the “Plus or Minus button” to set the correct output level.
- When the THUNDERBEAT and SONICBEAT are connected, press the “THUNDERBEAT button” and then set the output level in the “Set screen” .

Verifying the output

1. Preparation
Prepare a sterile container (like a bowl) with dimensions similar to those shown in Figure 5.14. Fill it with saline.

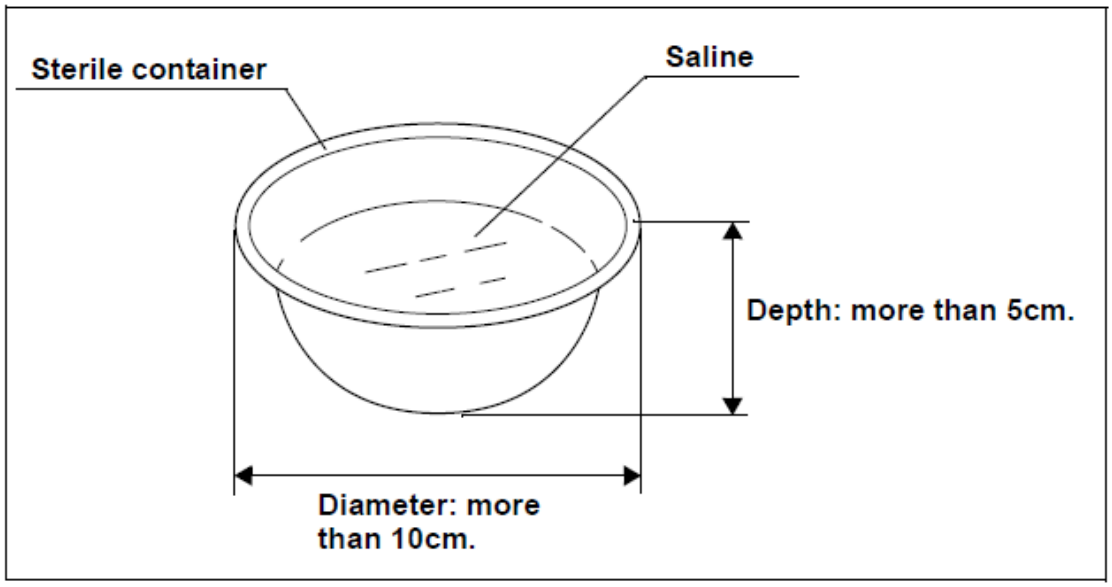


Figure 5.14

2. Grasping the gauze
Open the THUNDERBEAT grasping section and submerge only the distal half of the grasping section and the probe in saline (see Figures 5.15 and 5.16).

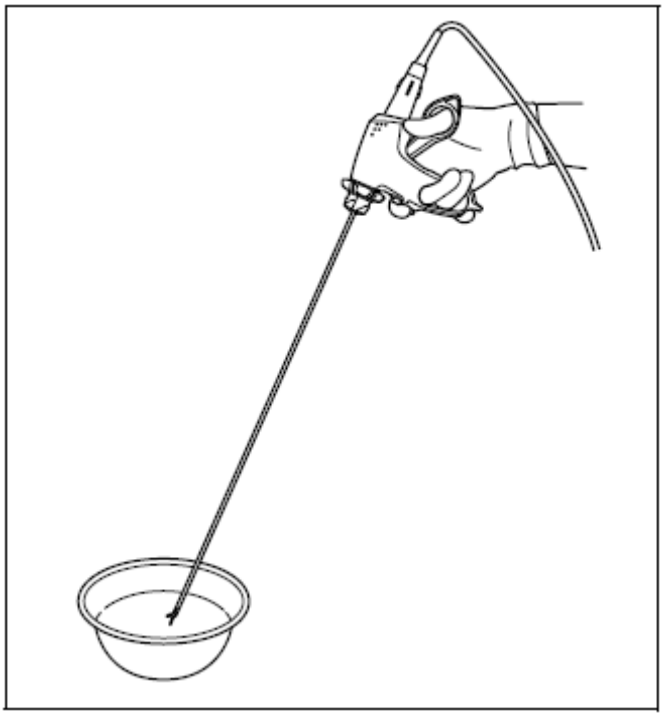


Figure 5.15

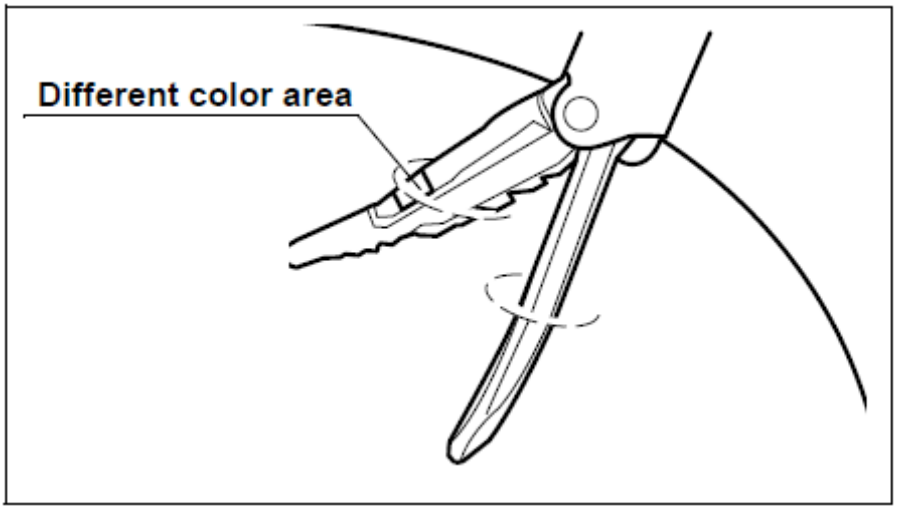


Figure 5.16

3. Activation
Press and hold the SEAL button (blue) of the handswitch or the SEAL pedal (right pedal: blue) of the footswitch for the high-frequency (RF bipolar) output.

4. Inspectiong the output
Confirm the following items during the SEAL mode output:

- The activation “All screen” or “Set screen” is displayed on the touch-screen of the ultrasonic generator, no error window (see Figure 5.17).

- The output tone sounds from the compatible electrosurgical generator.

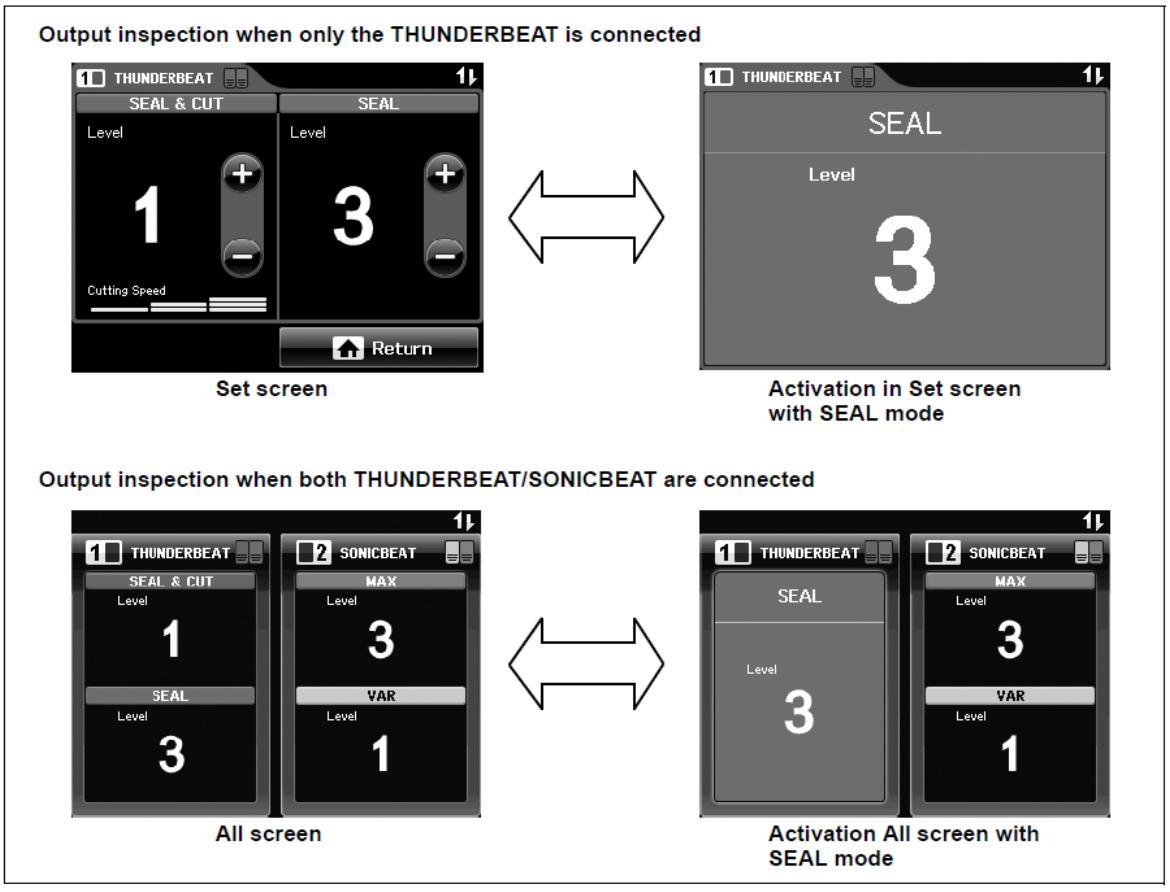


Figure 5.17

5. Activation stop
   After the confirmation, release the SEAL button of the handswitch or the SEAL pedal of the footswitch.

6. Cleaning
   Wipe any remaining saline on the probe tip with dry, sterile gauze.

8 Verification of the alarm system

Normal operation of the alarm system can be verified by intentionally generating an error.

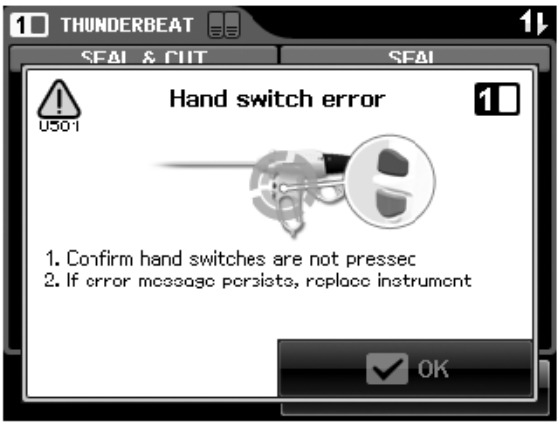
WARNING

- Before generating an alarm, be sure to confirm that the transducer plug is unplugged from the transducer socket of the ultrasonic generator. If the handswitch is depressed while the transducer plug is connected, an unintended output may cause burns..
- To prevent burns, do not touch the probe tip.

1. Disconnectig the transducer plug
   Disconnect the transducer plug from the transducer socket of the ultrasonic generator.

2. Generating an error (to activate the alarm system)
   While depressing the THUNDERBEAT or SONICBEAT handswitch, insert the transducer plug into the transducer socket of the ultrasonic generator.

   Confirm that the error window (handswitch error) is displayed on the touch-screen and that the alarm tone is generated (see Figure 5.18).

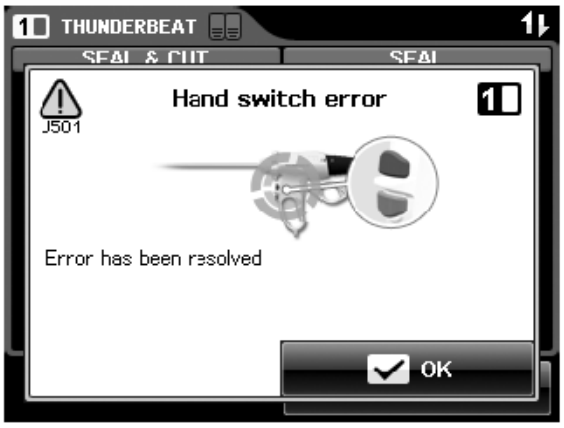


Error window
(U501: Handswitch error page 1)

Figure 5.18

3. Stopping the alarm tone
After confirming the error window on the touch-screen and the alarm tone, release the handswitch button on the THUNDERBEAT or SONICBEAT.

- The alarm tone stops.
- The error window on the touch-screen is replaced by the release of the error window (see Figure 5.19).



Error window
(U501: Handswitch error page 2)

Figure 5.19

4. Releasing the error
Press the “OK button” to clear the error window.

The error is cleared and the error window disappears from the touch-screen.

9 Procedure after verification

When using the THUNDERBEAT, turn the compatible electrosurgical generator OFF first, then turn OFF the ultrasonic generator (see Figure 5.20).

- The power switch is no longer illuminated.
- The touch-screen is no longer illuminated.
- The push buttons are no longer illuminated.

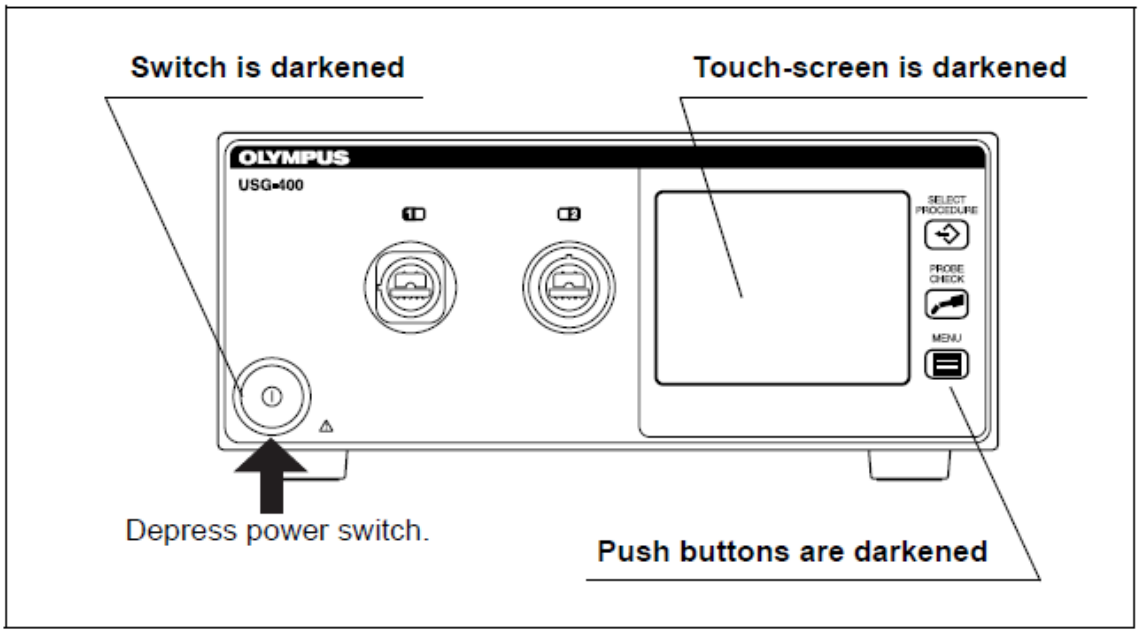


Figure 5.20

USG-400 INSPECTION CHECK SHEET（Please copy and use it）

USG-400 Serial nomber:

Month & Year /

Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Power verification															
Verification of communication cable connection between compatible electrosurgical generator and ultrasonic generator (when using the THUNDERBEAT)															
Verification of touch-screen and push buttons															
Verification of the THUNDERBEAT and / or SONICBEAT															
Verification of footswitch connection															
Vrification of the high-frequency(RF bipolar) output (when using the THUNDERBEAT)															
Verification of the alarm system															
Inspector															

Day	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Power verification																
Verification of communication cable connection between compatible electrosurgical generator and ultrasonic generator (when using the THUNDERBEAT)																
Verification of touch-screen and push buttons																
Verification of the THUNDERBEAT and / or SONICBEAT																
Verification of footswitch connection																
Vrification of the high-frequency(RF bipolar) output (when using the THUNDERBEAT)																
Verification of the alarm system																
Inspector																

Chapter 6 : Safety check

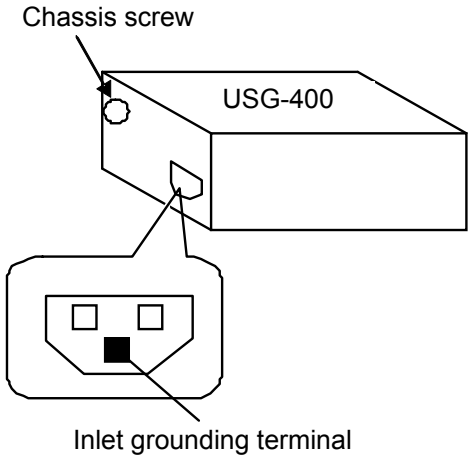
1 Check procedures 6-2
2 Check Card 6-6

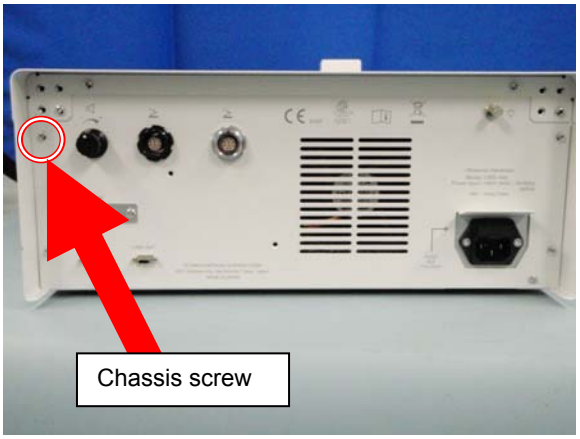
1 Check procedures

1-1 Grounding Resistance confirmation

○ Criteria
The resistance between an accessible metal part of the USG-400 and the grounding terminal of the meet must be 0.1Ω or less.

○ Inspection procedures
(1) Measure the resistance value between the inlet grounding terminal the exterior chassis screw farthest from the inlet to apply 25A (non-loaded condition : 6A or less) for five to ten seconds.





1-2 Ground leakage current confirmation

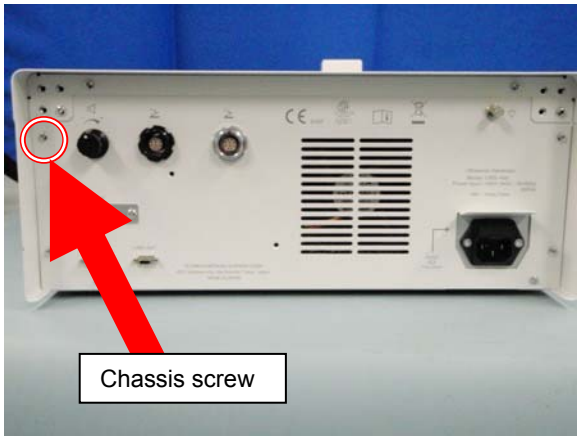
○ Criteria
The ground leakage current must not be over the value at the table 1-5.

○ Inspection procedures
(1) Make measurements at the grounding terminal of the inlet.

1-3 Enclosure leakage current confirmation

○ Criteria
The enclosure leakage current must not be over the value at the table 1-5.

○ Inspection procedures
(1) Make measurement at the exterior chassis screw farthest from the inlet.

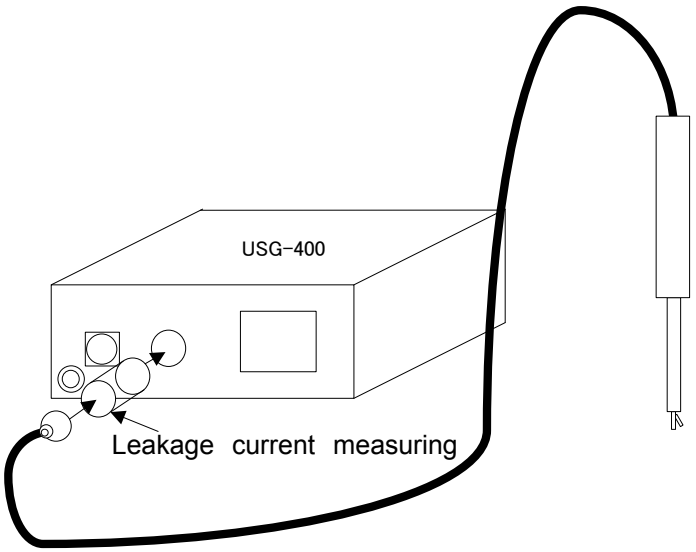


1-4 Patient leakage current confirmation

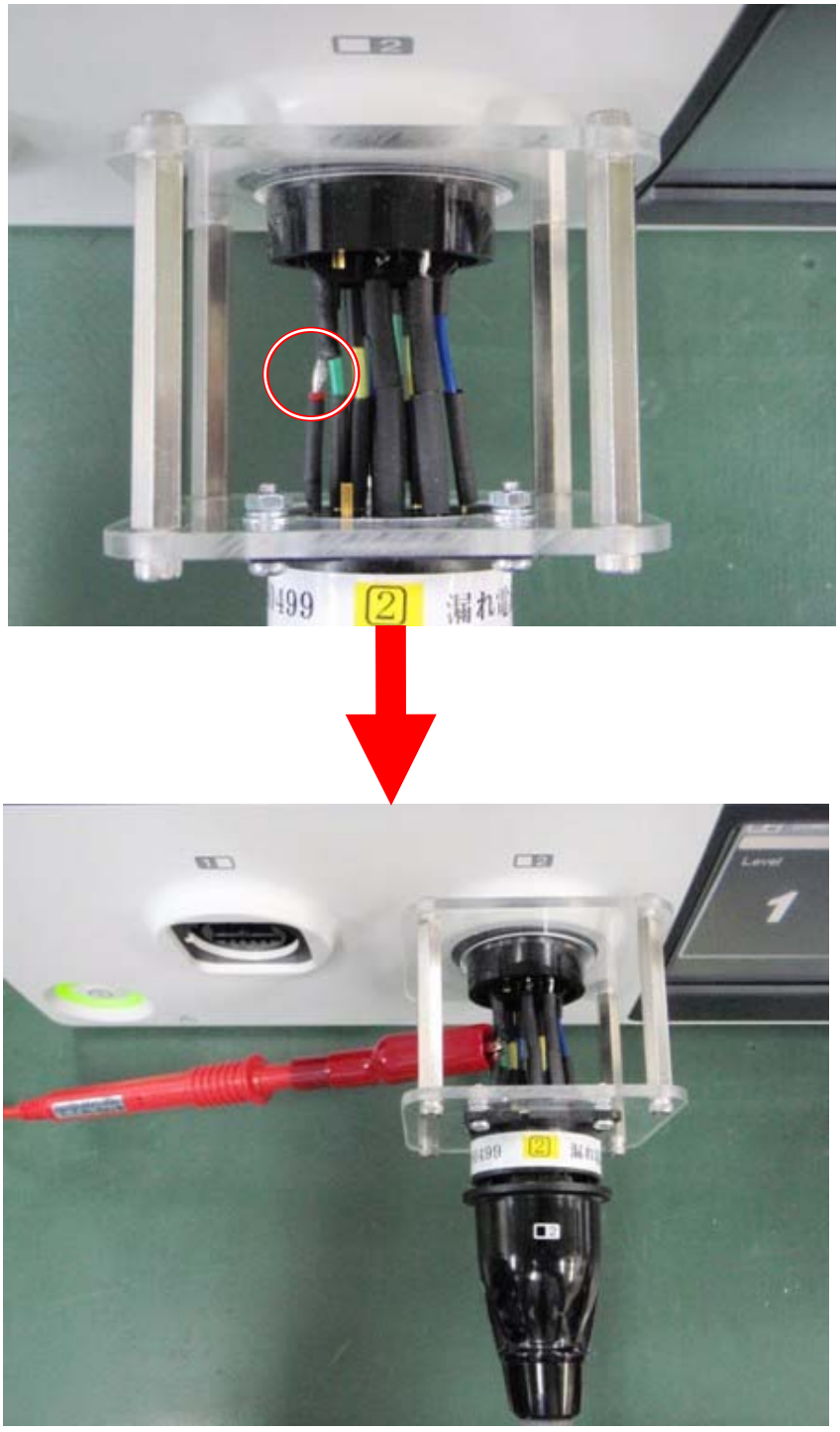
○ Criteria
The patient leakage current must not be the value at the table 1-5.

○ Inspection procedures
(1) Turn off the power switch of USG-400.

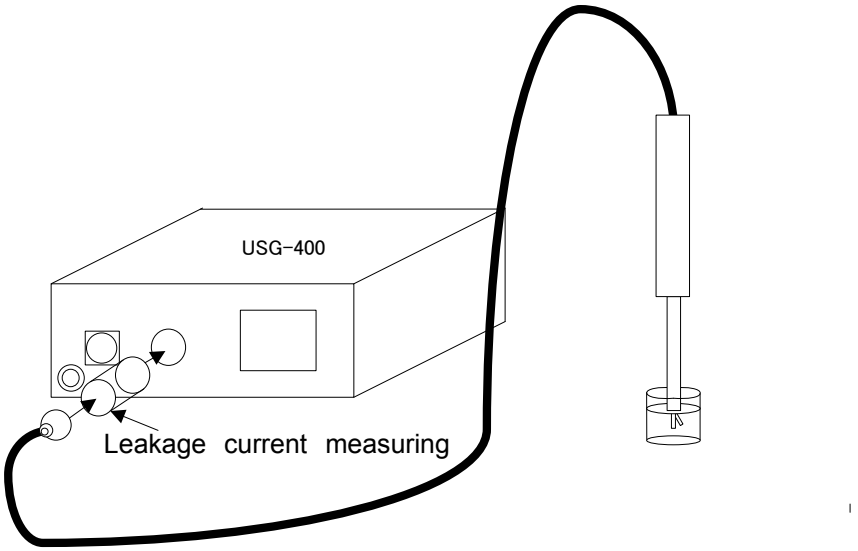
(2) Connect the Leakage current measuring jig (SS0499) to USG-400, and then connect the SONICBEAT Transducer with the SONICBEAT instrument (SB-0545PC or SB-0545IC) attached to it to the opposite side.



(3) Connect the Leakage current measuring jig (SS0499) to the Leakage current tester.



(4) Place the probe tip of SONICBEAT instrument in water.



(5) Turn on the power switch of USG-400, and then measure the leak current when the SONICBEAT is activating at level 3(either handswitch can be used)

1-5 Leakage current criteria

No	Mode	Criteria	
		Normal condition	Single fault condition
1	Ground leakage current	500μA	1000μA
2	Enclosure leakage current	100μA	500μA(others) 300μA(UL Deviation)
3	Patient leakage current	10μA	50μA

2 Check Card

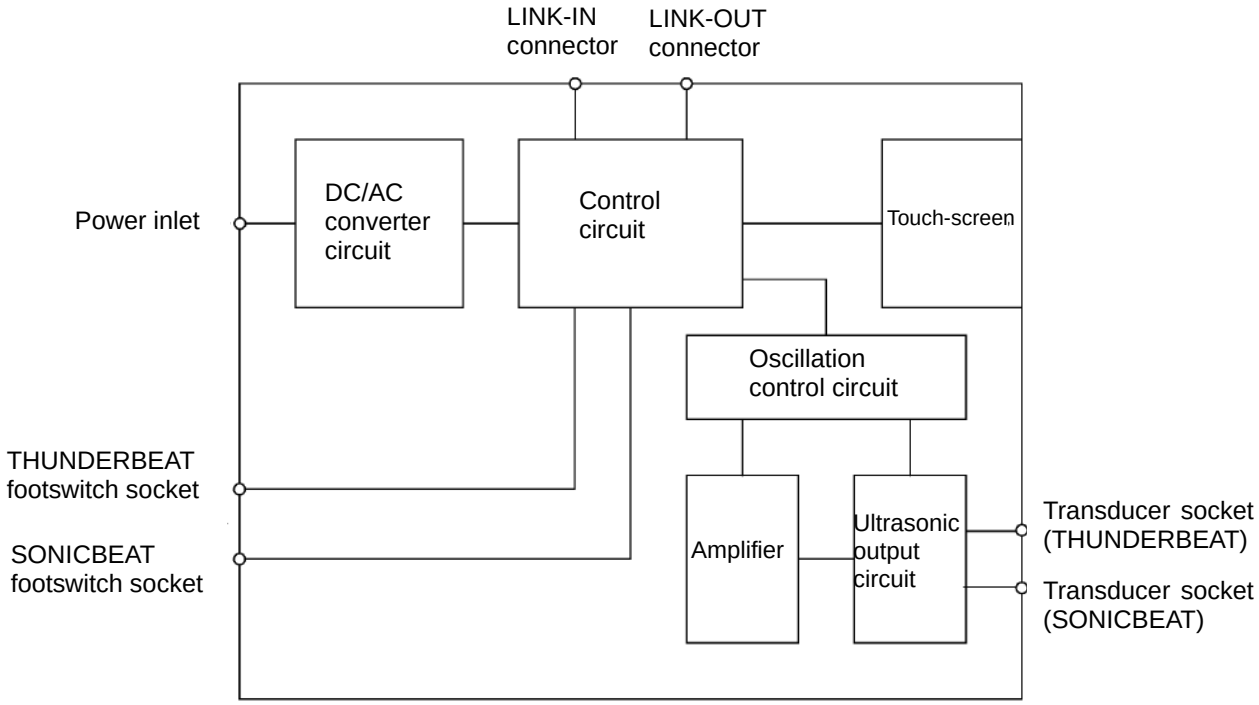
Date of check			
Product		SN	
Inspected by		Checked by	

Inspection item	Criteria		Measurement Equipment No.	result
Grounding Resistance	The resistance must be 0.1Ω			Ω
Ground leakage current	Normal Condition	500 μA		μA
	Single Fault	1000 μA		μA
Enclosure leakage current	Normal Condition	100 μA		μA
	Single Fault	500 μA 300 μA (UL Deviation)		μA
Patient leakage current	Normal Condition	AC 10 μA		μA
		DC 10 μA		μA
	Single Fault	AC 50 μA		μA
		DC 50 μA		μA

Chapter 7 : Block Diagram

1 Block Diagram 7-2

1 Block Diagram



Chapter 8 : Troubleshooting

1 Troubleshooting 8-2
2 Error screen 8-3
3 Troubleshooting guide 8-3
4 Returning the ultrasonic generator for repair 8-22

1 Troubleshooting

WARNING

- If the ultrasonicIf the ultrasonic generator does not work after the touch-screen displays irregularity, turn the ultrasonic generator OFF and then turn it ON again. Confirm that the output level setting returns to the normal state.
- Never use the ultrasonic generator on a patient when any irregularity is observed with the equipment. Otherwise, the system may not work properly and serious injury to the patient, surgical staff and/or surgeon may result.

If any irregularity is observed with the equipment, follow the below steps.

1. Immediately stop the procedure and remove any equipment from inside the body cavity.
2. Immediately stop the procedure and remove any equipment from inside the body cavity.
3. Check if any error window is displayed.
4. If an error window is displayed, first read Section 2, “Error screen” and Section 3, “Troubleshooting guide” and take proper remedial actions according to “What to do when an error code is displayed”
5. If no error window is displayed, take proper remedial actions according to “What to do when no error code is displayed”

2 Error screen

The error window is configured as shown below in Figure 8.1

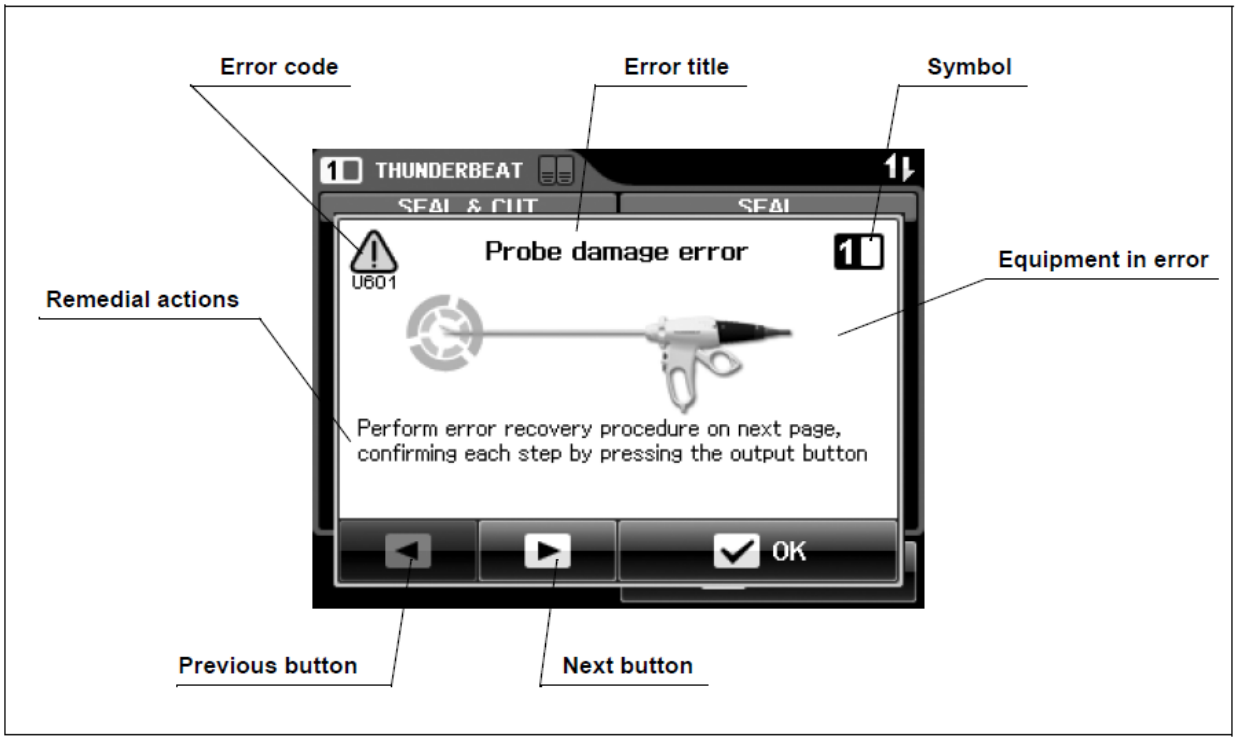


Figure 8.1

3 Troubleshooting guide

Types of error codes

The error windows are displayed in one of the following six patterns.

Pattern 1 Target error code: U001-U014

Pattern 2 Target error code: U501-U502, U507

Pattern 3 Target error code: U504

Pattern 4 Target error code: U508, U513

Pattern 5 Target error code: U509, U510, U511, U512, U514, U601

Pattern 6 Target error code: U503, U505-506

Pattern 1 Target error code: U001-U014

The error windows are displayed in one of the following five patterns.

Turn the ultrasonic generator OFF and ON again. If the error window is still displayed, disconnect the power supply and contact Olympus.

Target error code: U006

- Check if the THUNDERBEAT or SONICBEAT instrument and transducer are connected firmly. If not, connect them firmly.
- Turn the ultrasonic generator OFF and ON again. If the error window is still displayed, disconnect the power supply and contact Olympus.

Target error code: U010-U014

- The touch-screen, the handswitches, footswitch pedals, and push buttons on the ultrasonic generator are disabled.
- Perform the remedial actions in accordance with “What to do when an error code is displayed”
- If the error code is still displayed, disconnect the power supply and contact Olympus (see Figure 8.2).

Example: Target error

Error window (U001: USG-400 generator error)

Figure 8.2

Pattern 2 Target error code: U501-U502,U507

- The touch-screen, handswitches, footswitch pedals and push buttons are disabled.
- The “OK button” is illuminated when the error is cleared.
- When the “OK button” is pressed, the error window disappears and the display returns to the screen displayed before the error window was generated (see Figure 8.3).

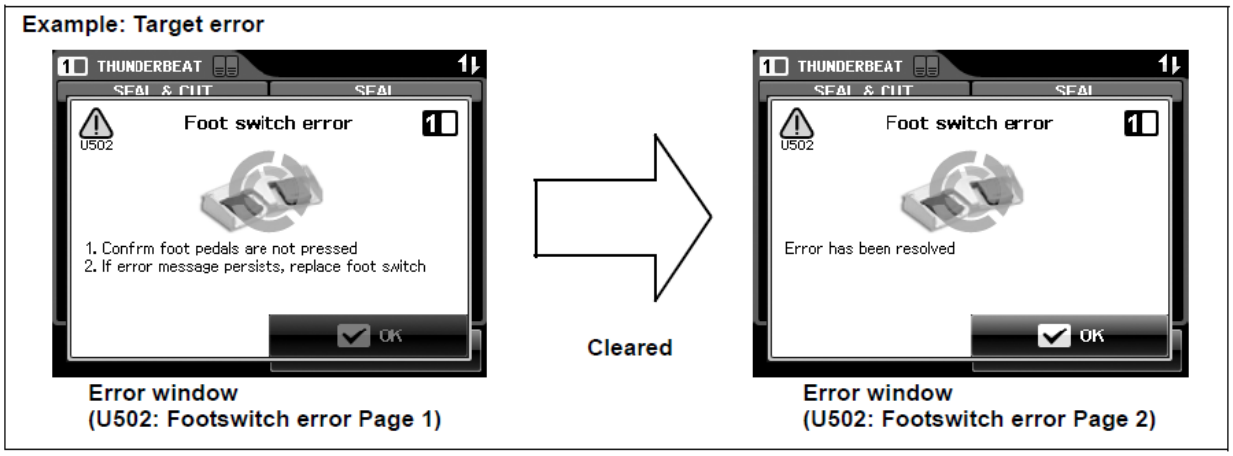


Figure 8.3

Pattern 3 Target error code: U504

WARNING

If the probe damage error occurs, do not turn OFF the ultrasonic generator, and do not disconnect the transducer plug from the transducer socket of the ultrasonic generator. Otherwise, damage or detachment of the probe tip may result and this may cause serious injury to the patient.

Energy output is not available when the error window (U504: Probe damage error) is displayed. In this case, perform the probe check. The output will become available when the confirmation window (Activation OK) is displayed.

Remedial actions:

1. Probe check push button
   Press the “PROBE CHECK push button” on the right side of the front panel (see Figure 8.4).

   The confirmation window (Probe Check) is displayed.

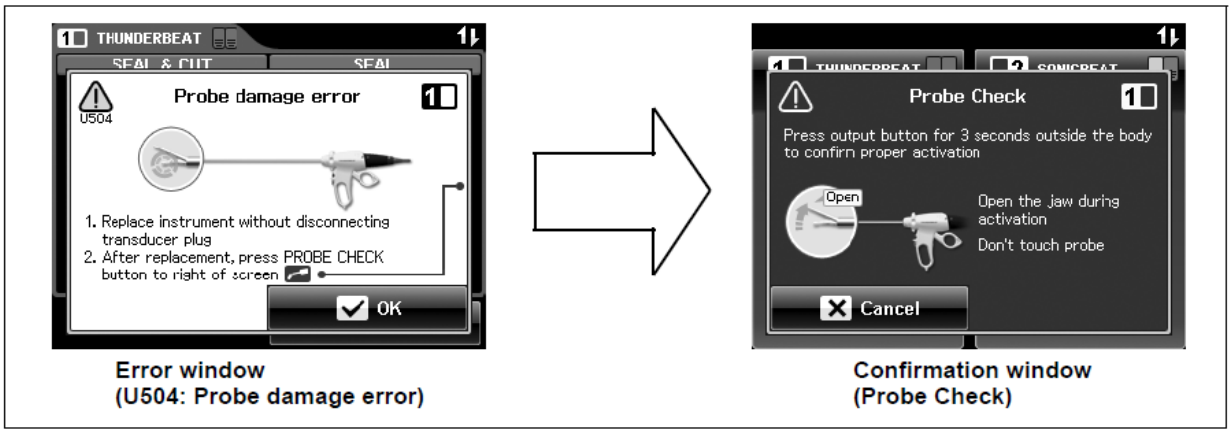


Figure 8.4

2. Executing the probe check
With the grasping section open, press and hold the handswitch or footswitch pedal for 3 seconds and then release it (see Figure 8.5)

- The probe check starts.
- The information window (Checking) is displayed.
- When the check completes, the information window (Checking) disappears and the probe check result is displayed.

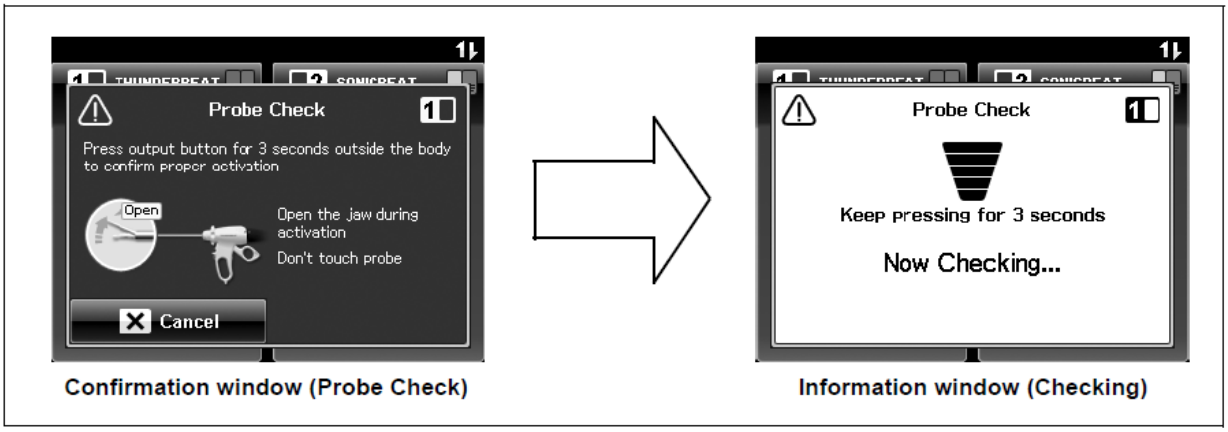


Figure 8.5

To cancel the probe check before the execution, press the “Cancel button” on the bottom left of the confirmation window (Probe Check).

The display returns from the confirmation window (Probe Check) to the “All screen” or “Set screen”.The confirmation window (Probe Check) is displayed.

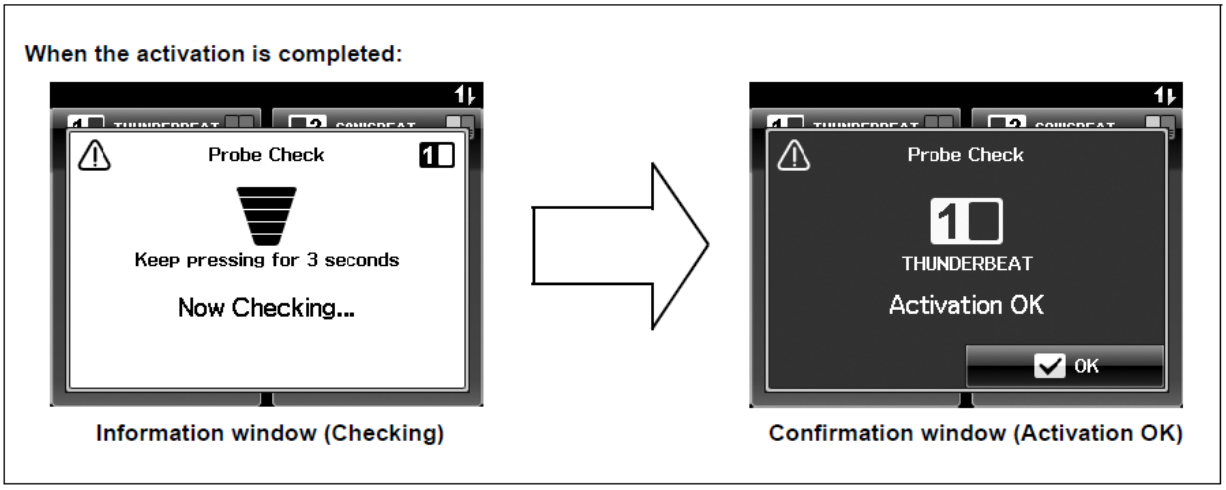


Figure 8.6

3. Probe check result
When the confirmation window (Activation OK) is displayed, press the “OK button” (see Figure 8.6).

The confirmation window (Activation OK) disappears and the “All screen” or “Set screen” is displayed (see Figure 8.7).

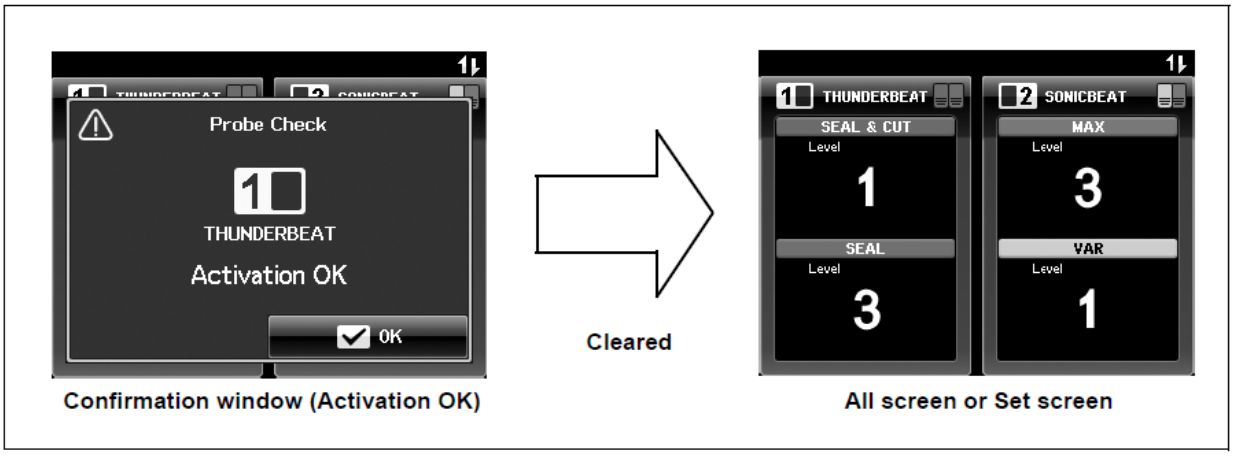


Figure 8.7

When this error window is displayed, take proper measures following pattern 5 in this chapter (see Figure 8.8).

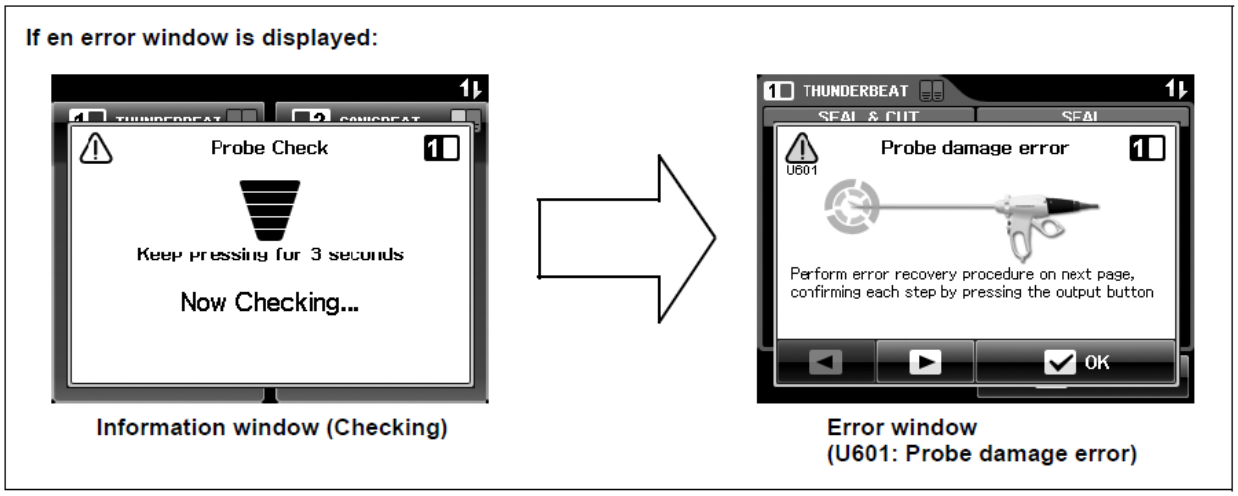
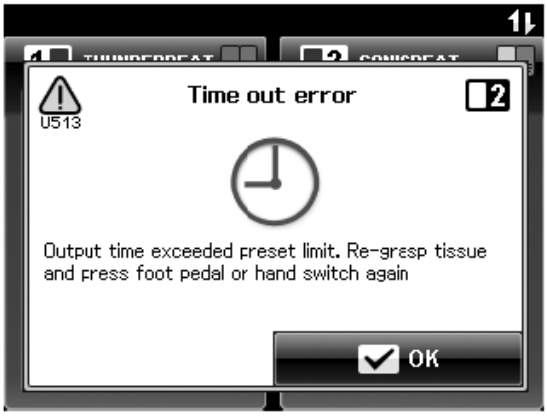


Figure 8.8

Pattern 4 Target error code: U508,U513

- The touch-screen, handswitches, footswitch pedals, and push buttons are available.
- Do not press the “OK button”, but proceed to the remedial actions on the error window or of “What to do when an error code is displayed”.
- If the “OK button” is pressed without taking the remedial actions, the error window disappears even when the error is not cleared.
- After taking each remedial action, be sure to perform the operation in Section 5.7, “Verification of the high-frequency (RF bipolar) output (when using the THUNDERBEAT)” in Chapter 5, “Inspection”.
- When the error window is not displayed after inspection, the error has been cleared.
- If the error window is still displayed, the error is not cleared. Take the next remedial action.

Example: Target error



Error window (513: ESG-400 communication error)

Figure 8.9

Pattern 5 Target error code: U509,U510,U511,U512,U514, and U601

- The error messages have two screens.
- The touch-screen, handswitches, footswitch pedals, and push buttons are available.
- Do not press the “OK button”, but pressing the “Next button”, perform to the remedial actions on the error window.
- If the “OK button” is pressed without taking the remedial actions, the error window disappears even if the error is not cleared.
- After taking each remedial action, be sure to perform the operation in Section 5.7, “Verification of the high-frequency (RF bipolar) output (when using the THUNDERBEAT)” in Chapter 5, ”Inspection”.
- When the error window is not displayed after inspection, the error has been cleared.
- If the error window is still displayed, the error is not cleared. Take the next remedial action.

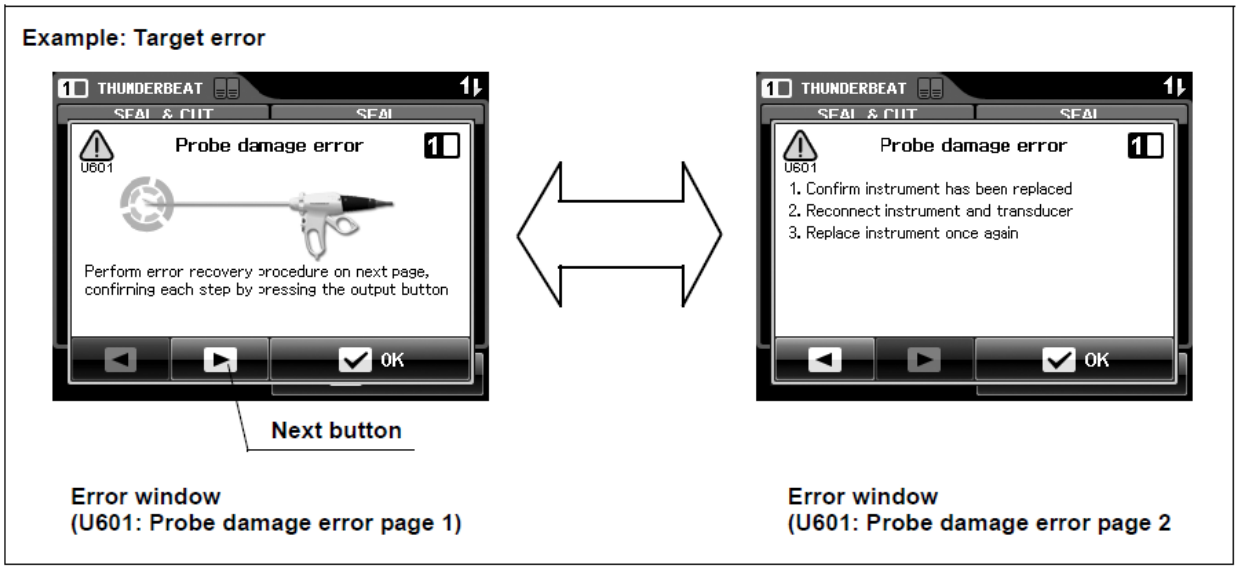


Figure 8.10

Pattern 6 Target error code: U503,U505,U506

- The touch-screen, handswitches, footswitch pedals, and push buttons are available.
- If the error is cleared, the error window disappears automatically.
- If the error window is still displayed, take the next remedial action.
- The error U505 has two pages for the remedial actions.

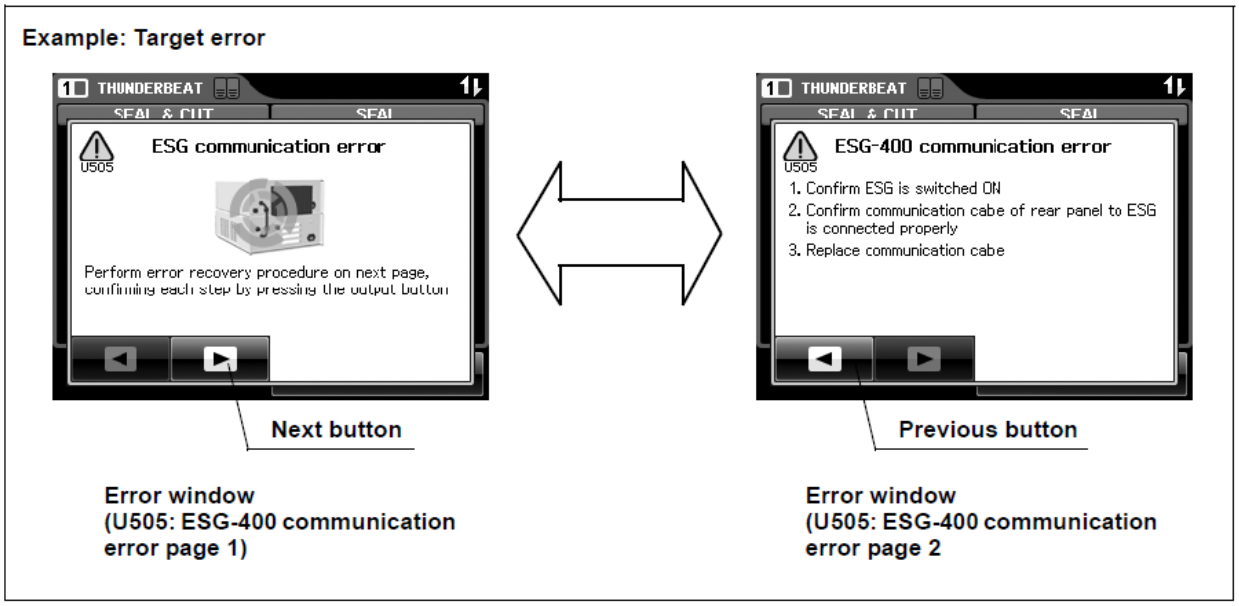


Figure 8.11

What to do when no error code is displayed

No error window is displayed and no alarm sounds in the following error status.
Perform the indicated remedial actions.

Irregularity Description	Possible cause	Remedial Actions
The ultrasonic generator cannot be turned ON.	The power cord is not connected.	Connect the power cord.
	The power cord is defective.	Replace the power cord.
	The power is not switched ON.	Press the power switch to ON.
	Ultrasonic generator malfunction.	Contact Olympus.
Energy output cannot be generated.	The transducer is not connected.	Connect the transducer.
	Transducer malfunction.	The transducer is abnormal. Immediately remove the THUNDERBEAT and/or SONICBEAT from the body cavity and replace the transducer.
	THUNDERBEAT or SONICBEAT instrument is not connected.	Connect the THUNDERBEAT or SONICBEAT instrument.
	THUNDERBEAT or SONICBEAT instrument malfunction.	The THUNDERBEAT or SONICBEAT instrument is defective. Remove the THUNDERBEAT and/or SONICBEAT from the body cavity and replace the THUNDERBEAT or SONICBEAT instrument.
	Footswitch is not connected.	Connect the footswitch.
	Footswitch malfunction.	Check the footswitch operation by referring to Section 5.7, “Verification of the high-frequency (RF bipolar) output (when using the THUNDERBEAT)”. If it is malfunctioning, replace it with a new one.
	The power is not switched ON.	Press the power switch to ON.
	Another instrument is generating energy output.	It is not permitted to generate outputs simultaneously from two instruments. Generate output from one instrument at a time.
	Compatible electrosurgical generator is generating the output.	Stop using the compatible electrosurgical generator (the THUNDERBEAT cannot be used when the compatible electrosurgical generator is in use).
	The touch-screen of the compatible electrosurgical generator is being operated.	Stop operating the touch-screen of the compatible electrosurgical generator (the THUNDERBEAT cannot be used when the touch-screen of the compatible electrosurgical generator is being operated).
	The other handswitch on the THUNDERBEAT or SONICBEAT or footswitch pedal than the intended one is being pressed (no activation).	Release all of the switches.

Irregularity Description	Possible cause	Remedial Actions
The output cannot be stopped.	THUNDERBEAT or SONICBEAT instrument malfunction.	The THUNDERBEAT or SONICBEAT instrument is defective. Remove the THUNDERBEAT and/or SONICBEAT from the body cavity and press the power switch to OFF. Replace the THUNDERBEAT or SONICBEAT instrument.
	Transducer malfunction.	The transducer is defective. Remove the THUNDERBEAT and/or SONICBEAT from the body cavity and press the power switch to OFF. Replace the transducer.
	Footswitch malfunction.	The footswitch is defective. Remove the THUNDERBEAT and/or SONICBEAT from the body cavity and press the power switch to OFF. Replace the footswitch.
	Ultrasonic generator malfunction.	Remove the THUNDERBEAT and/or SONICBEAT from the body cavity and press the power switch to OFF. Contact Olympus.
The touch-screen cannot be controlled.	An object is in contact with the touch-screen.	Remove the object.
	Touch-screen malfunction.	Remove the THUNDERBEAT and/or SONICBEAT from the body cavity and press the power switch to OFF. Contact Olympus.
The touch-screen remains dark after switching the ultrasonic generator ON (start tone is audible after switching ON).	Touch-screen malfunction.	Contact Olympus.
The ultrasonic generator does not react when a push button on the front panel is pressed during standby.	A push button is already pressed.	Release the push button.
	Ultrasonic generator malfunction.	Contact Olympus.
The ultrasonic generator does not react when a (push) button on the front panel is pressed.	The (push) buttons are not available during activation.	Release the footswitch or handswitch to stop the activation.
No sound is audible during activation.	The volume is set to an inaudible level (e.g. due to high environmental noise).	Increase the volume either on the touch-screen within the “Menu screen” or use the volume control on the rear panel of the ultrasonic generator.
	Ultrasonic generator malfunction	Stop using the ultrasonic generator and press the power switch to turn OFF the ultrasonic generator. Contact Olympus.
The error volume can not be adjusted.	The error volume is fixed.	No action required.
The output volume can not be adjusted.	Ultrasonic generator malfunction.	Contact Olympus.

Irregularity Description	Possible cause	Remedial Actions
The output volume of THUNDERBEAT can not be adjusted.	The output volume of THUNDERBEAT can not be adjusted with the ultrasonic generator.	Adjust the output volume of THUNDERBEAT with the compatible electrosurgical generator.
The ultrasonic generator cannot be turned OFF.	Ultrasonic generator malfunction.	Remove the THUNDERBEAT and/or SONICBEAT from the body cavity and press the power switch to OFF. Contact Olympus.
Automatic mist & smoke Evacuation system/function does not work.	The settings are erroneous.	Correct the settings of the compatible high flow insufflation unit.
	The communication cable is not connected.	Connect the communication cable. ”Automatic mist & smoke evacuationsystem/function (when using the compatible high flow insufflation unit)”
	The connection of the communication cable is erroneous.	Reconnect the communication cable. “Automatic mist & smoke evacuation system/function (when using the compatible high flow insufflation unit)”.
	Compatible high flow insufflation unit malfunction.	Contact Olympus.
	Ultrasonic generator, communication cable or adapter for UHI-2/3 malfunction	Remove the THUNDERBEAT and/or SONICBEAT from the body cavity and press the power switch to OFF. Contact Olympus.
Cutting/sealing/ coagulating does not work properly.	Operation is not appropriate.	Operate the instrument properly referring to Chapter 4, “Operation” in the instruction manual for THUNDERBEAT or SONICBEAT.
	The treated site is not appropriate.	Treat the adequate site referring to Chapter 4, “Operation” in the instruction manual for THUNDERBEAT or SONICBEAT.
	Carbonized tissue is present on the grasping section or the probe tip.	Remove the carbonized tissue from the grasping section or the probe tip with sterile gauze or soft brush.
	The output level setting is not appropriate.	Set the adequate output level referring to Chapter 3, “Preparation and Inspection” in the instruction manual for THUNDERBEAT or SONICBEAT.
	Deterioration of the transducer.	Confirm either whether one year has passed since the transducer was delivered or the use of the transducer has exceeded 100 cases. If it is applied to at least one of them, replace the transducer with a new one.
	Not activating output.	Refer to “Energy output cannot be enerated” of “What to do when no error code is displayed” in Section 8.3, “Troubleshooting guide”.

Irregularity Description	Possible cause	Remedial Actions
Unintended output (burns)	Operation is not appropriate.	Operate the instrument properly referring to Chapter 4, “Operation” in the instruction manual for THUNDERBEAT or SONICBEAT (Also, see “Heat temperature of the shaft” in the Appendix for details of the temperature).
	THUNDERBEAT or SONICBEAT instrument malfunction.	The THUNDERBEAT or SONICBEAT instrument is defective. Remove the THUNDERBEAT and/or SONICBEAT from the body cavity and press the power switch to OFF. Replace the THUNDERBEAT or SONICBEAT instrument.
	Footswitch malfunction.	The footswitch is defective. Remove the THUNDERBEAT and/or SONICBEAT from the body cavity and press the power switch to OFF. Replace the footswitch.
	Connection of the transducer with THUNDERBEAT or SONICBEAT instrument is loose.	Check if the THUNDERBEAT or SONICBEAT instrument and transducer are connected firmly. If not, connect them firmly.
	Transducer plug is not connected to the THUNDERBEAT or SONICBEAT socket properly.	Confirm that the transducer plug is connected to the THUNDERBEAT or SONICBEAT socket on the front panel of the ultrasonic generator. If not, connect it properly.
	Transducer malfunction.	The transducer is defective. Remove the THUNDERBEAT and/or SONICBEAT from the body cavity and press the power switch to OFF. Replace the transducer.
	Ultrasonic generator malfunction.	Remove the THUNDERBEAT and/or SONICBEAT from the body cavity and press the power switch to OFF. Contact Olympus.
Takes time to start up.	Shortage of power supply.	Connect the equipment so that the total capacitance of all equipment including the ultrasonic generator connected to the power outlet shall be smaller than that of power supply.
	The power cord is not connected.	Connect the power cord.
	Ultrasonic generator malfunction.	Remove the THUNDERBEAT and/or SONICBEAT from the body cavity and press the power switch to OFF. Contact Olympus.
Image of the touch-screen is distorted.	Image is distorted by noise influence.	Do not loop cords but separate them so that they will not contact the main bodies or cords of other medical electrical equipment (electrocardiograph, endoscopic video camera, etc.).

Irregularity Description	Possible cause	Remedial Actions
THUNDERBEAT and/or SONICBEAT is/are not identified.	Transducer plug is not connected to the THUNDERBEAT or SONICBEAT socket properly.	Confirm that the transducer plug is connected to the THUNDERBEAT or SONICBEAT socket on the front panel of the ultrasonic generator. If not, connect it properly.
	Transducer malfunction.	The transducer is defective. Replace the transducer.
	Ultrasonic generator malfunction.	Remove the THUNDERBEAT and/or SONICBEAT from the body cavity and press the power switch to OFF. Contact Olympus.
Footswitch is not identified.	The footswitch plug is not connected to the footswitch socket properly.	Connect the footswitch plug to the footswitch socket firmly.
	Footswitch malfunction.	The footswitch is defective. Remove the THUNDERBEAT and/or SONICBEAT from the body cavity and press the power switch to OFF. Replace the footswitch.
	Ultrasonic generator malfunction.	Remove the THUNDERBEAT and/or SONICBEAT from the body cavity and press the power switch to OFF. Contact Olympus.
The transducer is heated.	Transducer temperature is too high due to continuous output.	Stop output until the temperature cools down.
Difficult to grasp tissue.	Operation is not appropriate.	Operate the instrument properly referring to Chapter 4, “Operation” in the instruction manual for THUNDERBEAT or SONICBEAT.
	The treated site is not appropriate.	Treat the adequate site referring to Chapter 4, “Operation” in the instruction manual for THUNDERBEAT or SONICBEAT.
	The grasping surface (white Teflon surface) has been worn out.	If the grasping surface (white Teflon surface) has been worn out, replace THUNDERBEAT or SONICBEAT with a new one.
	Carbonized tissue is present on the grasping section or the probe tip.	Remove the carbonized tissue from the grasping section or the probe tip with sterile gauze or soft brush.
	THUNDERBEAT or SONICBEAT instrument malfunction.	The THUNDERBEAT or SONICBEAT instrument is defective. Remove the THUNDERBEAT and/or SONICBEAT from the body cavity and press the power switch to OFF. Replace the THUNDERBEAT or SONICBEAT instrument.
Opening and closing ofthe grasping section is stiff/can't open.	Carbonized tissue is present onthe grasping section or the probe tip.	Remove the carbonized tissue from the grasping section or the probe tip with sterile gauze or soft brush.
	THUNDERBEAT or SONICBEAT instrument malfunction.	The THUNDERBEAT or SONICBEAT instrument is defective. Remove the THUNDERBEAT and/or SONICBEAT from the body cavity and press the power switch to OFF. Replace the THUNDERBEAT or SONICBEAT instrument.

What to do when error code is displayed

Find the applicable error code from the following table and take the actions indicated in “Remedial actions”.

Error Code	Irregularity Description	Possible cause	Remedial Actions
U001	USG-400 generator error (Configuration malfunction)	Ultrasonic generator malfunction due to the fail of the internal circuitry of the ultrasonic generator.	Turn the ultrasonic generator OFF and ON again. If the error window is still displayed, contact Olympus.
U002	USG-400 generator error (FPGA (software) malfunction)	Same as the above.	Same as the above.
U003	USG-400 generator error (Output switch circuit malfunction)	Same as the above.	Same as the above.
U004	USG-400 generator error (Error circuit malfunction)	Same as the above.	Same as the above.
U005	USG-400 generator error (Handpiece detection circuit malfunction)	Same as the above.	Same as the above.
U006	USG-400 generator error (Output detection circuit malfunction)	Connection of the transducer with THUNDERBEAT or SONICBEAT instrument is loose.	1.Check if the THUNDERBEAT or SONICBEAT instrument and transducer are connected firmly. If not, connect them firmly.
		Ultrasonic generator malfunction due to the fail of the internal circuitry of the ultrasonic generator.	2.Turn the ultrasonic generator OFF and ON again. If the error window is still displayed, contact Olympus.
U007	USG-400 generator error (Memory damage)	Ultrasonic generator malfunction due to the fail of the internal circuitry of the ultrasonic generator.	Turn the ultrasonic generator OFF and ON again. If the error window is still displayed, contact Olympus.
U008	USG-400 generator error (Touch-screen malfunction)	Same as the above.	Same as the above.

Error Code	Irregularity Description	Possible cause	Remedial Actions
U009	USG-400 generator error (Calibration malfunction)	Ultrasonic generator malfunction due to the fail of the internal circuitry of the ultrasonic generator.	Turn the ultrasonic generator OFF and ON again. If the error window is still displayed, contact Olympus.
U010	Overcurrent error	Ultrasonic generator malfunction.	1.Turn the ultrasonic generator OFF then ON again. Confirm instrument activation. 2. If no output, replace transducer. repeat step 1. 3. If the error window is still displayed, contact Olympus.
		Transducer malfunction.	
U011	Cooling fan error	Foreign object is caught in rear cooling fan.	1. Confirm a foreign substance object is not caught in rear vent holes, then turn the ultrasonic generator OFF and ON again.
		Ultrasonic generator malfunction.	2. If the error window is still displayed, contact Olympus.
U012	Overheated circuit error	Fan entrance/exit is blocked.	1. Confirm vent holes are not covered by an obstacle, and then turn the ultrasonic generator OFF and ON again.
		Ultrasonic generator malfunction.	2. If the error window is still displayed, contact Olympus.
U013	Touch-screen error	Touch-screen was pressed when the ultrasonic generator was turned ON.	1. Turn the ultrasonic generator OFF and ON again without touching the touch-screen.
		Touch-screen malfunction (a foreign substance object such as dust may be stuck between the touch-screen and front panel).	2. Remove the foreign substance object and turn the ultrasonic generator OFF and ON again.
		Touch-screen malfunction.	3. If the error window is still displayed, contact Olympus.
U014	Push button error	A push button was pressed when the ultrasonic generator was turned ON.	1. Turn the ultrasonic generator OFF and ON again without touching the push button.
		Push buttons malfunction.	2. If the error window is still displayed, contact Olympus.
U501	Handswitch error	Handswitch was pressed when the ultrasonic generator was turned ON.	1. Turn the ultrasonic generator OFF and ON again without touching the handswitch.
		Handswitch malfunction.	2. If the error window is still displayed, replace the THUNDERBEAT or SONICBEAT instrument.
		Ultrasonic generator malfunction.	3. If the error window is still displayed, contact Olympus.

Error Code	Irregularity Description	Possible cause	Remedial Actions
U502	Footswitch error	Footswitch pedal was pressed when the ultrasonic generator is turned ON.	1. Turn the ultrasonic generator OFF and ON again without pressing the footswitch pedal.
		Footswitch malfunction.	2. If the error window is still displayed, replace the footswitch.
		Ultrasonic generator malfunction.	3. If the error window is still displayed, contact Olympus.
U503	System connection error	A unit with overlapped ID is connected. Example: When two compatible electrosurgical generators are connected.	1. Confirm the system does not have multiple same generators.
		System connection malfunction.	2. If the error window is still displayed, contact Olympus.
U504	Probe damageerror (which isdetected during surgery)	Cracked probe.	Replace THUNDERBEAT or SONICBEAT without disconnecting transducer plug. After replacement, press the PROBE CHECK push button to confirm that the new instrument works normally.
U505	ESG communication error	Compatible electrosurgical generator is not turned ON.	1. Confirm the compatible electrosurgical generator is switched ON. If not, turn it ON.
		Communication cable to the compatible electrosurgical generator is not connected.	2. Confirm the communication cable of rear panel to the compatible electrosurgical generator is connected properly. If not, connect it properly.
		Communication cable wire disconnection.	3. Replace the communication cable.
		Ultrasonic generator malfunction.	4. Contact Olympus.
U506	ESG docking error	Compatible electrosurgical generator is not connected.	1. Confirm the compatible electrosurgical generator is properly connected. If not, connect it properly.
		Ultrasonic generator malfunction.	2. Contact Olympus.
U507	Unsupported ESG error	The software version of the connected compatible electrosurgical generator is not supported.	Contact Olympus (Connected ESG not supported by USG-400).

Error Code	Irregularity Description	Possible cause	Remedial Actions
U508	SEAL & CUT short circuit error	Output is generated while a metallic object is grasped.	1. Confirm no metal object is grasped between jaw and probe, then confirm activation.
		Output in body fluids.	2. Remove excess fluids in the body.
		Grasping section wear.	3. If the error window is still displayed, replace the THUNDERBEAT or SONICBEAT instrument.
U509	Ultrasonic level error	Hard tissue (e.g., bone) is caught.	1. Do not grasp the hard tissue.
		Excessive load is applied to the distal end.	2. Reduce force applied to distal end of the probe.
		Connection of the transducer with THUNDERBEAT or SONICBEAT instrument is loose.	3. Check if the THUNDERBEAT or SONICBEAT instrument and transducer are connected firmly. If not, connect them firmly.
		Transducer plug is not connected to the THUNDERBEAT or SONICBEAT socket properly.	4. Confirm that the transducer plug is connected to the THUNDERBEAT or SONICBEAT socket on the front panel of the ultrasonic generator. If not, connect it properly.
		Transducer malfunction.	5. Replace the transducer.
		Probe damage or malfunction.	6. Replace the THUNDERBEAT or SONICBEAT instrument.
		Ultrasonic generator malfunction.	7. Contact Olympus.

Error Code	Irregularity Description	Possible cause	Remedial Actions
U510	Ultrasonic frequency error (which is detected during surgery)	Hard tissue (e.g., bone) is caught.	1. Do not grasp the hard tissue.
		Excessive load is applied to the distal end.	2. Reduce force applied to distal end of the probe.
		Connection of the transducer with THUNDERBEAT or SONICBEAT instrument is loose.	3. Check if the THUNDERBEAT or SONICBEAT instrument and transducer are connected firmly. If not, connect them firmly.
		Transducer plug is not connected to the THUNDERBEAT or SONICBEAT socket properly.	4. Confirm that the transducer plug is connected to the THUNDERBEAT or SONICBEAT socket on the front panel of the ultrasonic generator. If not, connect it properly.
		Transducer temperature is too high due to continuous output.	5. Stop output until the temperature cools down.
		Transducer temperature is too high due to use immediately after autoclaving.	6. Allow the transducer temperature to cool.
		Transducer malfunction.	7. Replace the transducer.
		Probe damage or malfunction.	8. Replace the THUNDERBEAT or SONICBEAT instrument.
		Ultrasonic generator malfunction.	9. Contact Olympus.
U511	SEAL short circuit error	Output is generated while a metallic object is touched.	1. Make sure that no metallic object is grasped.
		Output in body fluids	2. Remove excess fluids in the body.
		Grasping section wear.	3. If the error window is still displayed, replace the THUNDERBEAT or SONICBEAT instrument.
U512	Open circuit error	The fully assembly instrument is activated without holding tissue.	1. Re-grasp tissue and confirm activation.
		Transducer and THUNDERBEAT instrument are not connected properly.	2. Check if the THUNDERBEAT instrument and transducer are connected. If not, connect them properly.
		Transducer plug is not connected to the THUNDERBEAT socket properly.	3. Confirm that the transducer plug is connected to the THUNDERBEAT socket on the front panel of the ultrasonic generator. If not, connect it properly.
		Transducer malfunction.	4. Replace the transducer.
		The THUNDERBEAT instrument malfunction.	5. Replace the THUNDERBEAT instrument.
		Ultrasonic generator malfunction.	6. Contact Olympus.

Error Code	Irregularity Description	Possible cause	Remedial Actions
U513	Time out error (SEAL & CUT, MAX, VAR)	Output time period is longer than allowable by the system (maximum output time: 60 s).	The maximum output time period has been expired. Re-grasp the tissue and confirm activation.
U514	Time out error (SEAL incomplete)	The specified output time period has expired (maximum output time: 15 s).	Remove tissue or fluids from jaw and probe. Re-grasp tissue and confirm activation.
U601	Probe damage error (which is detected through PROBE CHECK)	Cracked probe.	1. Confirm that the probe tip is not broken. Press the PROBE CHECK push button, open the grasping section and confirm the normal operation. If the probe is broken, replace the THUNDERBEAT or SONICBEAT instrument.
		Excessive load is applied to the distal end.	2. Reduce force applied to distal end of the probe.
		Connection of the transducer with THUNDERBEAT or SONICBEAT instrument is loose.	3. Check if the THUNDERBEAT or SONICBEAT instrument and transducer are connected firmly. If not, connect them firmly.
		Transducer plug is not connected o the THUNDERBEAT or ONICBEAT socket properly.	4. Confirm that the transducer plug is connected to the THUNDERBEAT or SONICBEAT socket on the front panel of the ultrasonic generator. If not, connect it properly.
		Transducer temperature is too high due to use immediately after autoclaving.	5. Allow the transducer temperature cool prior to use.
		Transducer temperature is too high due to continuous output.	6. Stop output until the temperature cools down.
		Transducer malfunction.	7. Replace the transducer.
		Probe damage or malfunction.	8. Replace the THUNDERBEAT or SONICBEAT instrument.
		Ultrasonic generator malfunction.	9. Contact Olympus.

3 Returning the ultrasonic generator for repair

WARNING

- Before returning the ultrasonic generator for repair, be sure to disinfect it as described in Chapter 4, “Care, Storage, and Disposal”. If the ultrasonic generator is not disinfected, cross-contamination of the surrounding environment may result.
- Olympus will not assume any liabilities for human injuries or equipment damage caused as a result of servicing or repair by a person other than the Olympus qualified service personnel.

When returning the ultrasonic generator for repair, contact Olympus. With the ultrasonic generator, include a description of the malfunction or damage and the name and telephone number of the individual at your location who is most familiar with the problem. Include a repair purchase order.

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